AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 11, No. 36. WEEKLY. | NEW YORK, SEPTEMBER 8, 1888. | $2.50 per Annum. SINGLE COPIES 5 CENTS.

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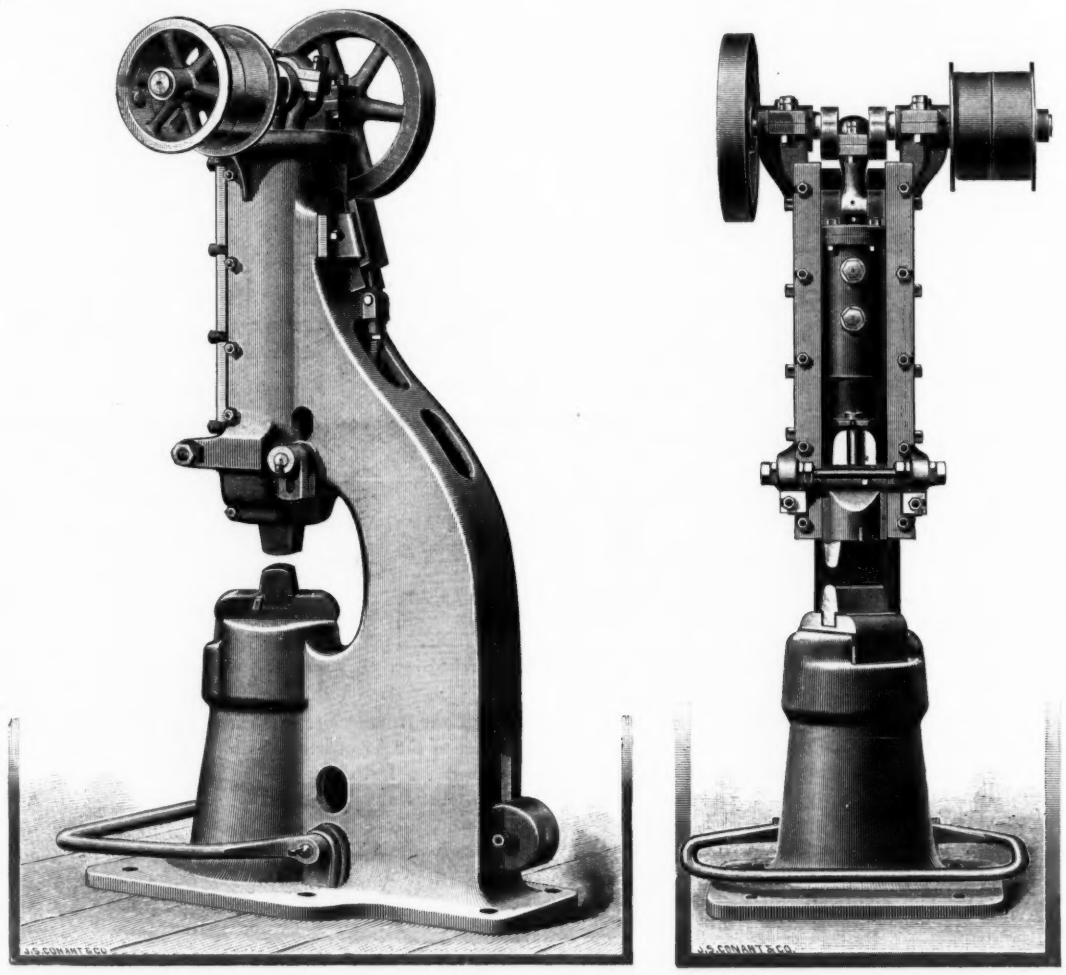
The Hackney Pneumatic Power Hammer.

This hammer is driven by a belt running directly from the line shaft to the pulley shown on the crank shaft at the top of hammer frame. A regular connecting rod, fastened at one end to the crank and at the other to the top of the cylinder, gives to the latter a positive up and down motion between vertical guides. To the bore of this cylinder is fitted a piston with rod attached. This rod extends down through a stuffing box at the lower part of cylinder, and to its end the hammer head is securely keyed. This hammer head receives additional stability side-ways by being fitted to slide between the same guides as the cylinder.

From the following it will be readily understood how the up and down motion of the cylinder is communicated to the piston: The piston is suspended in the cylinder between two air cushions, and the efficiency of this cushioning depends on the volume of the air thus confined. Permanent air cushions would be practically impossible in the cylinder, because leakage due to wear of stuffing box and piston packing must soon impair their efficiency. Such cushions are, therefore, not depended upon, but new ones are formed at each stroke by admitting fresh air into both ends of the cylinder through two inlet valves shown in the front of the cylinder—one near the lower and one near the upper end. The lower cushion simply serves to lift the weight of the piston and attached parts.

With the upper cushion the case is different. This is de pended upon not only to cushion the hammer and stop the upward motion of the parts, but also to furnish elasticity and power for the whole force of the blow. When a very heavy, powerful blow is wanted, this cushion should be extra stiff and strong but when a light blow only is needed, then a delicate cushioning will suffice. When intermediate gradations of blows are required the cushioning should be proportionately suited. This is accomplished by regulating at each stroke the amount of air confined by the outlet valve located at the back of the cylinder, near its upper end.

It must first be remembered that when the belt is once "thrown on" the crank shaft, connecting rod and cylinder, are in continual motion, and this outlet valve moves up and down in front of the wedge shown in cut, which is connected with the treadle by means of levers. In its normal position, the wedge being down, the valve is open, and the cylinder, traveling up and down, has no effect on the piston, because the enclosed air can rush out through the open valve and it is not compressed sufficiently to force the piston to travel with it. The moment, however, that the treadle is depressed, the wedge pushes up and forward against the valve stem, and by pressing it in, closes the valve and forms an air cushion, which carries the piston with it with a force proportionate to the pressure on the treadle, and the stiffness of the cushion thereby formed. The instant the treadle is released, the motion of the piston, hammer head, etc., stops. It is desirable that the head should always stop "up." This is also accomplished by means of the treadle, which, simultaneously with its release action on the valve, also forces against both sides of the hammer head, loose guide shoes, which thereby either retard the head or stop it completely in a raised position.



THE HACKNEY PNEUMATIC HAMMER.

From the foregoing description it will be evident that the hammer strikes a light or heavy blow without in any way affecting or changing the speed of the cylinder, for which special advantage is claimed, for the cylinder is continually moving at full speed, and thus imparts the same speed to the piston and hammer head, the instant they are thrown in. Even the first blow may therefore be given with full force and full speed. In this respect the operation is exactly like that of the steam hammer, for the operator is enabled to strike at will either one, two, or any number of successive blows, with full force.

To understand the strength of blow possible to strike with this hammer, it must be borne in mind that the piston receives not only the momentum due to the downward motion of the cylinder, but also the full reaction of the enclosed compressed air.

It is impossible to choke the hammer by suddenly putting between the dies a piece of iron fully as high as the lift of the head, for even then the motion of the reciprocating parts continues as the air cushion takes up all the undue strain.

It is not always necessary to keep the cylinder in motion when the hammer is not in use, for the driving belt may be shifted from tight to loose pulley. The fly-wheel shown on the other end of the crank shaft is simply to preserve the momentum.

Every precaution is taken to construct the hammer, not only to be effective, but also durable, and for that reason means are provided for taking up all wear where there is a probability of such occurring. The guides are adjustable, and the stuffing-box is kept air tight, with improved packing, same as on the steam engine or steam hammer. The steel die holder, being independent of the anvil block, can be removed at any time if the die slot should become worn.

In addition to the special claims made for this hammer it strikes a true, square blow, whether the work is thick or thin, and it is impossible to choke it. It requires no helper; the repairs are little or nothing; no helve to break; no springs to crystallize; no leather to burn. It is also claimed that it can be run with less power than any other hammer of same capacity, and that it occupies less space. The crank shaft running at a high rate of speed, it takes but a very narrow belt to run it. No counter-shaft or belt tightener is necessary, and there are no belts in the way of the operator.

The hammer is self-contained, and ready to run as soon as it is belted up.

This hammer is made in seven sizes, viz.: 50-lb., 75-lb., 100-lb., 150-lb., 200-lb., 300-lb., and 500-lb., these sizes being determined by the weight of the falling parts, viz., piston and rod with hammer head and top die.

The general selling agents are Hill, Clarke & Co., 156 Oliver street, Boston, Mass.

To Determine the Best Form of Teeth for Gear Patterns.

BY ISAAC WHITEHEAD.

SECOND PAPER.

It will be noticed that, in the application of the principles of the epicycloidal or other forms of teeth, many systems may be adopted, according to fancy or experience, and the class of work for which the wheels are required. It is evident, also, that, to be most effective, the face and flank of tooth should be as near a radial line as is consistent with the strength of tooth required, and the curvature necessary to obtain a perfect driving contact. In the case of cast gears it is policy to make the root stronger, thus strengthening the sand between the teeth, and so ensuring a more perfect mould with the least distortion from loosening the patterns. To determine the pitch it is considered desirable that at least three teeth should be engaged at one time. In large gears, especially when cut, there is special attention given to meet all the requirements in the case, independently of the systems adopted for general gearing, so we have firms that adopt a special system for that class, which embodies their private ideas and fancied points of advantage.

The closer we follow the principles involved, the better will be the result. Of course accuracy in spacing and uniformity of shape are all-important. It is an advantage, in all cases, to work a fillet at the root of the tooth, the best form being elliptical, the spring of the curve commencing as high as the point of contact in the action of the tooth. In cut gears it is just as easy to form an elliptical curve at the root as a circular one, but not so in the pattern shop, so that in cast gears the radial curve is adopted.

One of the first steps to establish uniformity in gearing is an arrangement of a diagonal scale for the proportions of teeth, which is shown in Fig. 1, page 2. It is very convenient and useful, giving all the sizes at a glance, which are quickly applied with the compasses for any pitch. In practice, it is sometimes laid out on paper and mounted on card, or laid out on a triangular set square with a scratch awl.

Prof. Willis was the first to formulate an odontograph, by which the centers for radius curves may be determined, to form the curves at root and point of tooth which would approximate to the epicycloidal curve, and so

arranged that teeth of any sized wheel of the same pitch would work together as nearly perfect as the conditions will allow. A full description of its application may be found in Knight's Mechanical Encyclopedia.

The next system in general use is Walker's Gear Scale, which is used by some of the largest firms in this country that make gearing a specialty. It consists of an extension of the diagonal scale shown, to give the radius of curves to be used in the formation of the face and root of the teeth, with also an additional scale giving the width of tooth at top, and another for the base, and from these points, with the radius of curves, the path of centers for radius is found. As far as I have observed, this system establishes a uniformly stronger tooth at the root than Prof. Willis', and therefore moulds cleaner and better, and for this reason I would judge it to be better adapted for the heavy and general work of gearing.

Another system which is growing in favor is Prof. Robinson's Templet Odontograph. It is claimed for this that it gives a curve of rapidly changing curvature, having the closest possible osculation with the epicycloidal or involute curve, and at the same time it will be of general application. It is also claimed to be handier in its application, having no centers to find. The manner in which it is applied is shown very clearly in an article on "Gear Patterns," by P. S. Dingey, AMERICAN MACHINIST of June 30th, 1888.

Another system, if it may be so called, which I have met with largely in jobbing shops West, is to take the pitch as a radius and find a center on the pitch line, from which is described both the root and face of the tooth. When, in the case of small pinion patterns, this would make the teeth too weak below the pitch line, the radius center is raised above the pitch line, at the discretion of the workman. If a pair are being made the tops of the teeth of the wheel will be contracted to correspond. This has been called the millwright's system.

TO FIND A FORM OF TOOTH TO MATCH A GIVEN FORM.

It often occurs that it is required to match a gear that has been made from one of these unknown systems; for instance, in case the pinion teeth are worn out, or that it is desired to change the diameter of one of the gears. Perhaps the wheel to be matched is uniformly out of ordinary shape. In such cases the following will be found a very practical method of finding the form required.

From *A*, Fig. 2, describe the pitch radius of the wheel, and from *B* describe the pitch radius of the pinion required to work with it. Cut out two light boards wide enough to take in the length of contact, say at least three times the pitch, and cut out carefully the arcs of the radius on the pitch line *A E' D'* and *B E D*. Mount them on a board with screws in centers, *A* and *B*, so that the two arcs will work in contact with each other. Scribe a groove on face of arcs, then fasten a line by a tack at *D*, and lay it along the groove to *D'*, then across under the board to *E'*, then along the groove to *E*, where it is drawn tight and fastened at each point. The two arcs will now work together at the same velocity at the pitch line. Now make a card templet of one or two of the teeth of the given wheel, as shown at *T*, and tack it upon the sector, carefully setting it by the pitch lines. On sector *B* tack a piece of blank paper, cut out to the radius of outside of tooth, setting it by the pitch, and allowing it to work freely under the card templet *T*. It will be readily seen that, in the course of the revolving of templet, the teeth upon blank paper cover the space necessary, and that by penciling the outline of teeth during its progress it will mark out the exact form of spaces necessary, and so give the outline of teeth required. If the one side of given tooth is uniformly differently shaped, by wear or otherwise, to the other side, this method will give the different shape required for each side. In allowing the clearance, it improves its working to allow a very slight fullness on the face of tooth near the pitch line, as it will wear and bed itself quicker into smooth working by its so taking up the slight imperfections of spacing in such cases.

English and American Locomotive Practice.

By W. H. BOOTH.

FOURTH PAPER.

Excepting in the very earliest engines, the wheels of some of which were made partly of wood, the use of cast-iron as a material for wheels in English locomotives has only been known within quite the last few years, during which cast-iron wheel centers have become quite common for the comparatively small diameters used on freight engines. Though it has proved quite satisfactory for freight traffic, no English superintendent would dream of using cast-iron as a material for a passenger engine wheel, and especially for a high speed engine of any type. Now cast-iron wheels are nearly universal in America, where they are spun round at as high a velocity as any English wrought-iron wheel.

There are good reasons for this difference in practice. American cast-iron is of very excellent quality, and is safe in localities where only wrought-iron would be employed in England. Till recently all English wheels have been of wrought-iron, and they are most reliable, and of course far better than any cast-iron wheel can be. The days of the wrought wheel are, however, now almost gone by, and before very long it is tolerably certain that all English wheels will be of cast-steel, a material cheaper to shape into a wheel than wrought-iron, and fully as reliable. Similarly, the cast-iron wheel in America must go. In this item, then, of wheels, the practice of the two countries, hitherto so different, appears likely soon to become identical. In cast-iron wheels the practice in England is to use a spoke or arm of H section, which makes a wheel far less sightly than the oval arm of the American wheel; the object being to save the labor of the cores.

In steel wheels the old flat arm pattern of the wrought-iron wheel has been adhered to as suited to the newer material in wheels of the larger sizes, but for truck wheels oval arms have been employed of heavy section with good results and appearance, and there is a rapidly growing opinion in favor of cast-steel for many other engineering purposes. Indeed, the inferiority of the English cast-iron has been the cause, so far, of the expensive but excellent wrought wheel, and is now a help again to the introduction of the cheap steel wheel, which great advance in practice is checked in America by the excellence of American cast-iron, which is good enough to do for present service, but perhaps hardly to be relied upon for future needs, and therefore its excellence is now rather barring the way to improvements.

The great use to which American engineers put cast-iron is of course due to its excellence. There is one use for it, however, which I should like to see stopped. I refer to its use as the material for steam dome crowns. For such a purpose it should not be employed, even though it is standing up to such work in so many thousands of engines. Cast-iron is, even at its best, not a really safe material to form part of a steam boiler, and, with the advance in steam pressures now proceeding, should cease to be so employed any longer.

Properly supported, cast-iron is an excellent material for slide bars, and serves as our material for smoke-box doors and steam pipes in the smoke-box, which in England are of wrought plate and copper respectively.

In the matter of external parts, the American cab differs from the English cab in being very much larger, more closed in, and in being constructed of wood instead of iron. The American cab stands out sufficiently far from the boiler to admit of a door opening out from its front end to allow the engineer to step out upon the running board. To the American engineer the English cab will appear as small as does the American "running board" to the English driver. In an English engine the upper half of the wheels is not merely covered over by a splasher, but the face of the wheel is closed in by a plate. The wheel thus is closed in a circular shaped flat box, which is attached to the "foot-plate." This foot-plate is a broad table extending all round the engine and securely attached by angle irons to the upper edge of the frame plates. It thus serves the purpose of the American running board, than which it is, however, far safer and more convenient; but to get upon it from the cab is by no means as safe as it should be. In all the foregoing details, from cab to foot-plate and wheel covers, the influence of climate is very marked. A boxed-in wheel would probably be sadly hampered in an American frost, and without a protecting cab of wood it is said that an engineer could not exist in the cold winters of America. The range of temperature in England, from 10° to 80°, is so moderate that the smaller shelter of the English iron cab is there a greater protection than is the American cab against a temperature which varies between —40° and +100°. Again, the broad English foot-plate would be unsuited for a country of heavy snow-falls, and so we see good reasons for apparently unnecessary variations in practice.

Pilots are never seen in England, because every line is so securely fenced in that no animal larger than a hen or a small dog ever gets run over, and grade crossings, which are almost unknown, are always fully protected by a watchman in charge of folding gates.

Though main line traffic in England is conducted with large-wheeled engines, there is an immense amount of local stopping traffic, for which small but heavy tank engines are used. These have three pairs of coupled wheels of very moderate diameter—smaller than the wheels in use for similar traffic in America. Purely local traffic in England appears to be very much better understood and looked after than in America, and the facilities for suburban residence are very much greater. Commutation rates are proportionately very much lower, besides being more liberal, in that, if he chooses, the holder of a commutation ticket may travel incessantly, and in England it is nothing unusual, indeed, it is very common, for commuters, or contractors as there termed, to return home at midday when resident not beyond seven miles out. This local traffic pays well, and to work it a special type of engine has been called into existence on many lines, of the type named above, handy in action and quick to start or stop, and capable of a speed of 30 miles, comfortably.

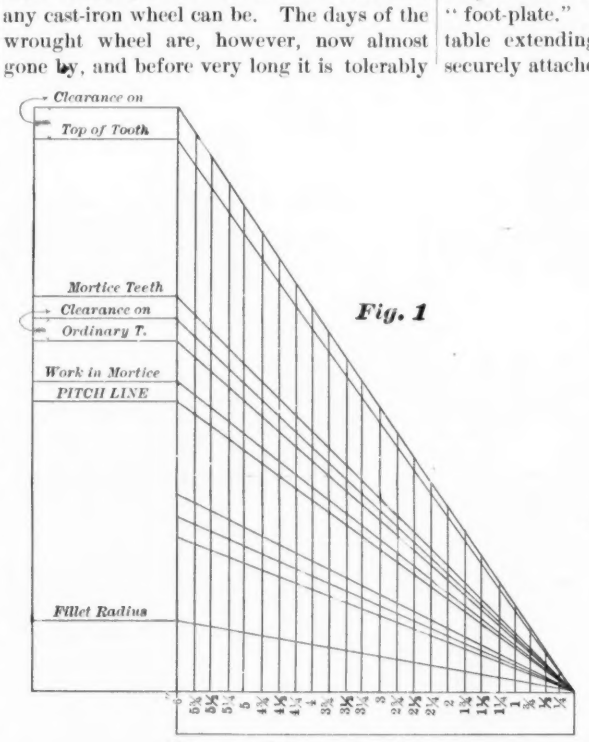


Fig. 1

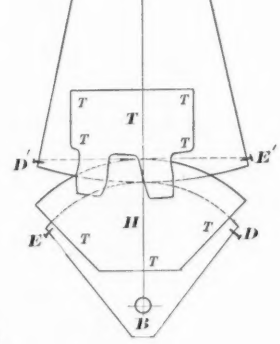


Fig. 2

FORM OF TEETH FOR GEAR PATTERN.—SEE PAGE 1.

Practical Drawing.

By J. G. A. MEYER.

FIFTY-EIGHTH PAPER.

Problem 72.

487. *Intersection of the surfaces of two right cylinders whose axes are not in the same plane.*

FIG. 370, page 3. Let $a\ a_3\ b\ b_3$ be the vertical projection of a right cylinder; and $e\ e_3\ f\ f_3$ the vertical projection of a smaller cylinder passed through the former. Also, let $a_2\ b_2\ c_2\ d_2$, Fig. 371, be the horizontal projection of the large cylinder; and $i_2\ e_{12}\ k_2 f_{12}$, the horizontal projection of the smaller one. Or, in practical language, let Fig. 370 represent an elevation, and Fig. 371 a plan of the two cylinders.

In Fig. 371 the point x is the horizontal projection of the axis of the large cylinder; and the line $y_2\ y_4$, the horizontal projection of the axis of the small cylinder. The projections of these axes show that they do not lie in one and the same plane. These are the conditions for the relative positions of the two cylinders. It is required to find the intersection of the cylindrical surfaces, that is, their intersection as shown in Fig. 370, of which the curve containing the points from 1 to 7 is a part.

For finding the curve of intersection we need, besides the two views already given, another view or vertical projection, such as is shown in Fig. 372. In this view the line $a_5\ a_{15}$ represents the vertical projection of the axis of the large cylinder, and the point y the vertical projection of the axis of the small cylinder; and, if correctly drawn, the distance from the point y to the line $a_5\ a_{15}$ will be equal to the distance from the point x to the line $y_2\ y_4$, in Fig. 371.

In Fig. 370, the lines $e\ e_3$ and $e_5\ f_5$ are the vertical projections of the axes of the same cylinders. Under the given conditions the curve of intersection, in Fig. 370, will be perfectly symmetrical, and consequently we only need to find, by construction, a portion of the curve; for instance, the portion containing the points 1, 2, 3, 4, 5, 6 and 7; and this course, for the sake of brevity, will be adopted in the present problem.

Here, as in the previous problems, we simply find, by construction, a number of points in the required curve of intersection; for instance, we find the points marked 1, 2, 3, up to 7; the curve drawn through these points will be a portion of the required curve of intersection. We will first briefly explain the construction for finding these points, and afterwards examine the principles upon which this construction is based.

In Fig. 371, draw through the center x a horizontal line $y_2\ h_2$, cutting the circumference $a_2\ b_2\ c_2\ d_2$ in the points $a_2\ b_2$. Now notice, the line $i_2\ k_2$ (an element of the small cylindrical surface) cuts the same circumference in the points $i_4\ k_4$; and the line $y_2\ y_4$, that is, the line which represents the horizontal projection of the axis of the small cylinder, cuts the circumference in the points $a_4\ b_4$; and, lastly, the vertical line $x\ c_2$, drawn through the center x, cuts the circumference in the point c_2. Divide the arc which extends from the point b_4 to the point c_2 into any number of parts, say four; through the points of division b_6, b_8, b_{10} draw the horizontal lines $e_6\ f_6$, $e_8\ f_8$, $e_{10}\ f_{10}$. The first of these horizontal lines will cut the circum-

ference $a_2\ b_2\ c_2\ d_2$ in the points $a_6\ b_6$; the second in the points $a_8\ b_8$; the third in the points $a_{10}\ b_{10}$. Through the points b_4, b_6, b_8 and b_{10} draw vertical lines terminating (in Fig. 370) respectively in the points $b_5\ b_7\ b_9$ and b_{11}, all lying in the upper base $a\ b$ of the large cylinder.

Through the center y (Fig. 372) draw a vertical line $a_7\ a_{17}$. On the lower base $d_7\ c_7$, from the point a_{17}, lay off a point a_{19}; the distance between these points must be equal to that between the points y_2 and e_6, in Fig. 371. Again, from the point a_{17} lay off a point a_{21}; the distance between these points must be equal to $y_2\ e_8$; and, lastly, from a_{17} lay off a_{23}; this distance must be equal to $y_2\ e_{10}$. Through the points a_{19}, a_{21}, a_{23} draw vertical lines terminating in the upper base of the cylinder. These vertical lines cut the circumference of the small cylinder in the points $4e$, $5e$, $6e$ respectively, all above the center y; these lines will also cut the same circumference in points below the center y, but to these we do not need to pay any attention at present. Also notice, in Fig. 372, that the line $a_5\ a_{15}$—which is the vertical projection of the axis of the large cylinder—cuts the same circumference in the point $2e$; the vertical line drawn through the center y cuts the circumference in the point $3e$; the element $c_5\ c_7$ cuts the circumference in the point $7e$; and, lastly, the horizontal line drawn through the center y cuts the circumference in the point $1e$. Through the point $2e$ draw a horizontal line cutting the element $b\ b_3$ (Fig. 370) in the point 2; this point will be one of the points in the curve of intersection. Through the point $3e$ draw a horizontal line cutting the line $b_5\ b_{13}$ (Fig. 370) in the point 3; this will be another point in the curve of intersection. In a similar manner draw through the points $4e$, $5e$, $6e$ and $7e$ horizontal lines, the first cutting the line $b_7\ b_{15}$ in point 4; the second cutting the line $b_9\ b_{17}$ in point 5; the third cutting the line $b_{11}\ b_{19}$ in point 6; and the fourth cutting the line $c\ c_3$ in point 7. Lastly, through the point k_4, Fig. 371—that is, the point in which the element $i_2\ k_2$ of the small cylinder cuts the circumference of the large cylinder—draw a vertical line, cutting the horizontal line $e_5\ f_5$, in Fig. 370, in point 1. Join the points 1, 2, 3, 4, 5, 6 and 7 by a curve; this curve will be one-fourth of the whole curve of intersection.

The other portions of the curve of intersection, that is, the other quarters, are exactly like the one just found, and may be copied or found by a construction precisely similar to the foregoing.

488. Now let us examine the principles upon which this construction is based. In the first place, the horizontal projection of the cylinders must be drawn so that any or all the elements of the small cylindrical surface will be parallel to the vertical plane of projection, consequently the elements $i_2\ k_2$ and $e_{12}\ f_{12}$ must be drawn parallel to the ground line $A\ B$. Otherwise we cannot see the correct distance between the points 1 and 9 in Fig. 370, neither will we be able to see the correct horizontal distance between any points in the curve on the right-hand side of the center line $c\ c_3$ and corresponding points on the left-hand side of the same center line.

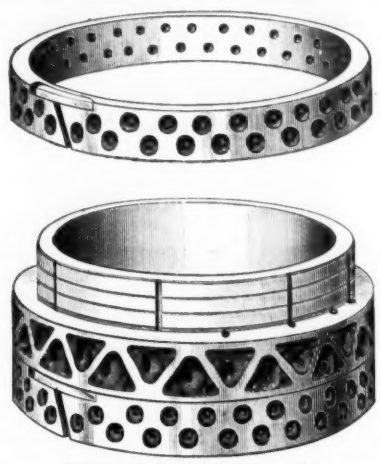
Assume now that in Fig. 371 the line $y_2\ h_2$ drawn through the center x represents a cutting plane perpendicular to the horizontal plane of projection. This cutting plane intersects the large cylindrical surface in two elements, represented by the points a_2, b_2; the vertical projection of the latter element is the line $b\ b_2$ in Fig. 370; that is to say, the point b_2 will be the horizontal projection, and the line $b\ b_2$ the vertical projection of one and the same element. This cutting plane is represented in Fig. 372 by the line $a_5\ a_{15}$, and cuts the circumference of the small cylinder in two elements; one of these is represented by the point marked $2e$; in fact, the point $2e$ represents the end of the element in which the cutting plane cuts the small cylindrical surface; this same element, or rather one-half of this element, is represented in Fig. 370 by the line $l_5\ f_5$. Hence we say that this cutting plane contains the element $b\ b_3$ of the large cylindrical surface and also the element $l_5\ f_5$ of the small cylindrical surface; consequently the point 2 (Fig. 370), in which these elements intersect each other, must be one point in the curve of intersection.

Now let the line $y_2\ y_4$ in Fig. 371 represent a second cutting plane perpendicular to the horizontal plane of projection. This cutting plane will be represented in Fig. 372 by the line $a_7\ a_{17}$. In Fig. 371 we notice that this cutting plane cuts the large cylindrical surface in an element which is represented by the point b_4; this same element is represented in Fig. 370 by the line $b_5\ b_{13}$. Again in Fig. 372 we notice that the cutting plane cuts the small cylindrical surface in an element which is represented by the point $3e$ and this element is represented in Fig. 370 by the line $e\ f$. Therefore the second cutting plane contains in Fig. 370 the elements $e\ f$ of the small cylinder and also the element $b_5\ b_{13}$ of the large cylinder, and the point 3, in which these elements intersect, must be a point in the curve of intersection.

In a similar manner we find the other points, 4, 5 and 6; that is to say, we assume the lines $e_6\ f_6$, $e_8\ f_8$, $e_{10}\ f_{10}$ to represent cutting planes, and then determine the elements of the large and small cylindrical surfaces which they contain; the points in which these elements in each cutting plane intersect each other will be points in the curve of insection.

In Fig. 370 we have, in that part of the curve of intersection which has just been found by construction, four distinct points, namely 1, 2, 3 and 7; these points can always be readily found thus: The horizontal projection of point 1 is represented by the point k_4 in Fig. 371, and since the point k_4 is established by the intersection of the element $i_2\ k_2$ with the circumference $a_2\ b_2\ c_2\ d_2$, and since $i_2\ k_2$ and the line $e_5\ f_5$ represent one and the same element of the small cylindrical surface, the point 1 is the intersection of the line $e_5\ f_5$ with the vertical line drawn through k_4. Here, then, we see that point 1 can be found without referring to Fig. 372.

The line $a_5\ a_{15}$ in Fig. 372 and the line $b\ b_3$ Fig. 370 represent one and the same element of the large cylindrical surface; and since the point $2e$ is established by the intersection of the line $a_5\ a_{15}$ with the circumference of the small cylinder, the point marked 2 in Fig. 370 must be the intersection of the element $b\ b_3$ with the horizontal line drawn through the point $2e$. Here we have found point 2 without referring to Fig. 371. The distance between point 2 and the line $c\ c_3$ will be greater than the distances between the same line and the points 3, 4, 5, 6, or any other point in the same portion of the curve of intersection.



ROGERS' PISTON PACKING.

The line $e\ f$ (Fig. 370) and the line $y_2\ y_4$ (Fig. 371), represent one and the same element of the small cylindrical surface. Now, since the point b_4 is established by the intersection of the line $y_2\ y_4$ with the circumference $a_2\ b_2\ c_2\ d_2$, and since b_4 is the horizontal projection of the point 3, the latter point must be the intersection of the element $e\ f$ with the vertical line drawn through the point b_4; and is found without referring to Fig. 372. The point 3 is one of the highest points in the curve of intersection above the line $e_5\ f_5$. Lastly the line $c\ c_3$ in Fig. 370 and the line $c_5\ c_7$ in Fig. 372 represent one and the same element of the large cylindrical surface. In the line $c_5\ c_7$ the point $7e$ is established, consequently the intersection of the line $c\ c_3$, Fig. 370, with the horizontal line drawn through the point $7e$ must be point 7. This point is the lowest point in the curve of intersection above the line $e_5\ f_5$.

For determining any of the intermediate points in the curve of intersection we need all the three views of the cylinders.

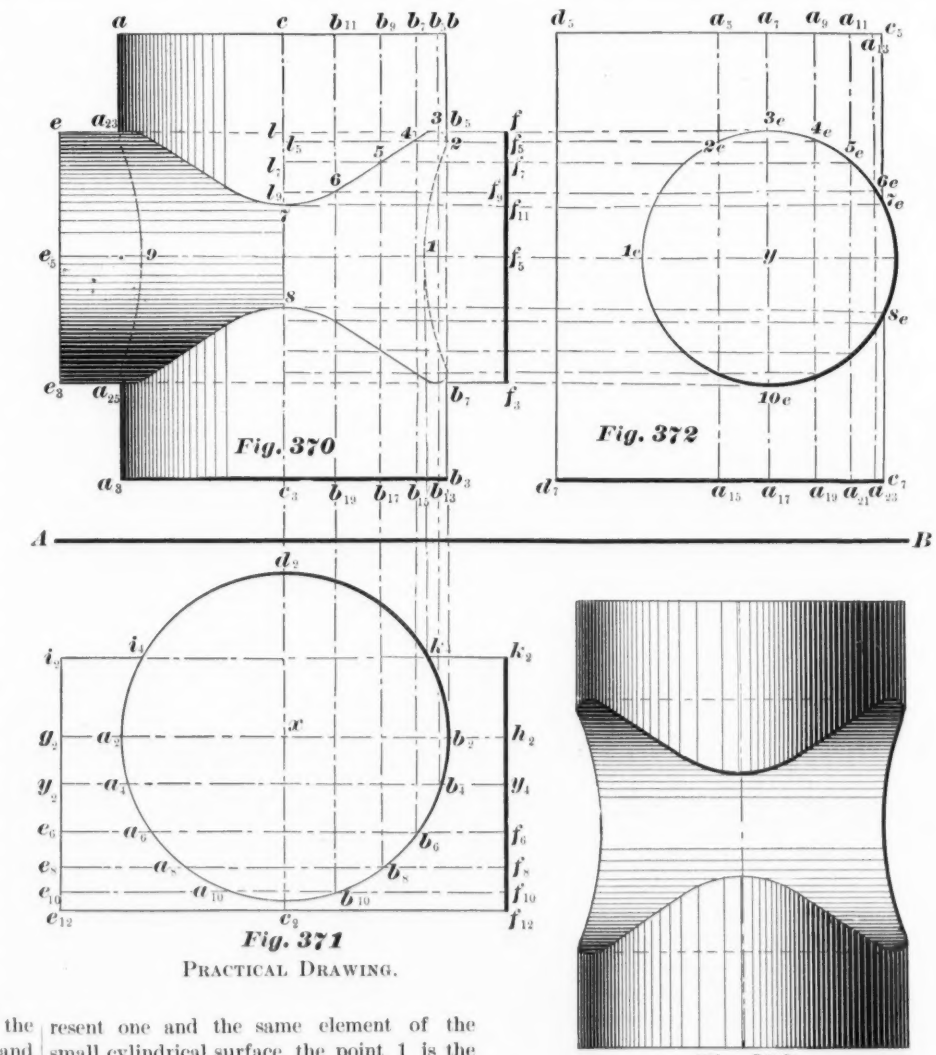


Fig. 371

PRACTICAL DRAWING.

Fig. 373

It may be well to remark that the point b_5 (Fig. 370) in which the element $b\ b_3$ of the large cylindrical surface appears to intersect the element $e\ f$ of the small cylindrical surface, is not a point in the curve of intersection, because in reality these two elements do not meet, as there is a space between them equal to the distance $g_2\ g_2$ in Fig. 371.

Fig. 373 represents the large cylinder, showing the opening made by passing the small cylinder through it.

Directions.—In space marked Prob. 72 draw the three views of the cylinders as shown in the illustrations. The large cylinder is to be 7 inches in diameter and 9½ inches long. The small cylinder, 5½ inches diameter and 9¾ inches long. The axis of the small cylinder is to be perpendicular to the axis of the larger one; the distance between the axes, that is, the distance $g_2\ g_2$ (Fig 371) is to be 1 inch. Find the intersection of the cylindrical surfaces. Use 3-inch scale.

Rogers' Piston Packing.

This packing is of the type in which a bull ring and two spring rings are employed. It is well known that, with this kind of packing, steam finds its way beneath the rings, thus forcing them against the walls of the cylinder with a force proportioned to the steam pressure, which may be so great as to cut the cylinder. The improvement in this packing is to the end of avoiding this, and also to relieve the bottom of the cylinder from part of the weight of the piston.

It will be observed that in this packing the spring rings are perforated. This removes outward pressure to that extent, and also provides for more complete lubrication.

The central part of bull ring is provided with cavities, as shown in the cut. They are partly intended for lubrication, and partly for balancing or carrying the piston in the cylinder. It will be seen on the cut that holes are drilled from some of the cavities to the grooves on the bull ring; the cavities thus connected are placed on the bottom of the cylinder and extend about one-third way around, and are supplied with steam from either side; the pressure is direct on the bottom of the cylinder, thus carrying the weight of the piston.

It is claimed for this packing that it saves in oil and in friction, giving corresponding increase in power, that the packing rings wear all around alike, and that the bottom of the cylinder is not worn low. It is designed for use in all classes of engines. The manufacturer is Charles Rogers, 72 Water street, Pittsburgh, Pa.

The chimney of Burns' Print Works, in Lodi, exploded, and the materials of which it was built were scattered about the yard, last Friday. The exact cause remains a mystery, but it is supposed that the aperture through which the smoke from the boilers escapes became clogged with soot, and that some species of powerful gas was thereby generated, which, being ignited by the heat from the boilers, exploded and wrecked the chimney. The mill was stopped for two days, but is now running, an iron-plated smoke-stack having been provided—*Passaic News.*

The Working Woman's Society, of New York, are dissatisfied with the progress of factory inspection. A speaker at a recent meeting of that society estimated that, at the present progress of inspection, it would require thirty years to go the rounds of the factories.

The Union Stone Co., of Boston, write us that their grinding attachment for lathes, illustrated in our issue of August 11, will grind tapers, or at any desired angle for short cuts, independently of set-over centers, compound rests, or taper attachments. This is done by sliding the spindle which carries the wheel through the sleeve which runs in the bearings and to which the pulley is attached—a button being placed on the end of the spindle for that purpose.

Globe Valve Patterns.

By F. W. Barrows.

SECOND PAPER.

Now, before putting on any more segments, let us turn out what we have already glued. You will see that it is easier to do this now than to wait until the whole box is laid up. Then build on again to within four or five courses of the top. Turn out the inside again, and while the box is still in the lathe, mark the center in the bottom of box, then put a piece of stuff across the top of box, cutting to such a length as will fit snugly in the box, and hold the piece even with the top on this piece; mark the center again. We are now ready to square up the outside of box. To do this, draw a line through the center, lay off on this line, each way from the center, the radius of flange we shall form on the branches, and draw lines through these points at right angles with the line passing through center. These lines now mark two opposite sides of outside of core box; lay off the other two sides at the same distance from center as the first. If it is found, from the design of valve body, or for any other reason, that it is not practicable to cut the four sides of box all at the same distance from center, we must change our plan and cut only three sides alike, and if this is not possible, then we must contrive to put in extra pieces on the short sides, to make three sides alike—it isn't likely that you will have any trouble of this kind in making an ordinary globe valve, and the four sides should form a perfect square, or, failing in this particular, the core-box won't be straight after it is all together.

After the center is sliced off to these lines, we will glue onto the top, at the corners, some blocks, to make up the height of the four or five courses of segments left off, and which would have been almost entirely cut off again, as will be seen by noting the size of the piece actually necessary to complete each of the four corners. By doing this you also get these corners, which are necessarily rather weak, in the best possible form, considering their size and shape. If these corners had been laid right up to the top with segments, the chances are that you would have had some vertical joints in these top courses, which would have made bad work; by putting on the five courses all at once you make a single piece take the place of at least five, and probably more.

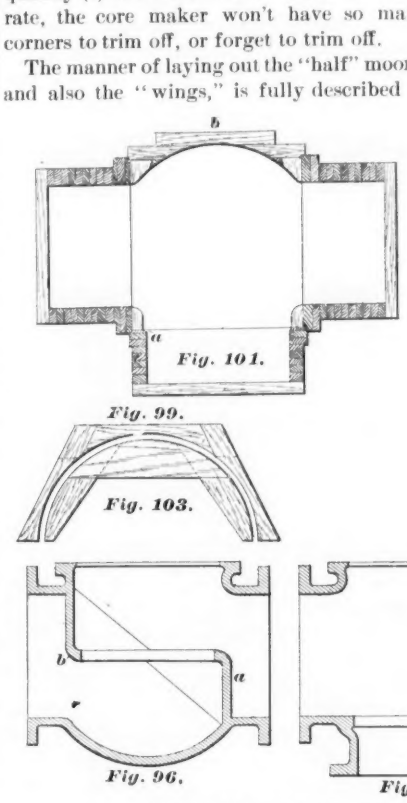
The next thing in order is to finish up the branches. As we are going to make only half a box, we shall have to turn up only one piece to make both pipe ends of box. For the hub or yoke end we will lay up only half the actual length of this branch, then saw the flange off of one half and glue the two halves together, end to end. Then cut off the level inside of shoulder at *a*, Fig. 101.

This provides for three sides of the box; before filling up the remaining side, let us round off the corners inside of box, where the branches enter the body of valve. In fastening the brances onto the center of box, be sure and get the two sides and the center all in a line, then the yoke end must be put on at right angles with the sides, and central between them. Without these precautions the two halves of core won't match together. After finishing the corners where the side branches enter, shift one of them around opposite the yoke, and finish this side like the two already finished. We should make these three sides, which are to form the pipe ends of valve, as near alike as possible, so that the ends of core-box may interchange.

For the fourth side of box we will make a piece like that shown in section at *b*, Fig. 101. This has a flange of the same diameter as flanges on pipe ends of box, and must be fitted to go on three sides of box. We are now ready to put in the partition which, in a globe valve, separates the inlet from the discharge.

Begin by laying up in segments a cylinder that will make the "wings," a section of which is shown at *a*, Fig. 96. The crescent shaped piece, commonly called the "half-moon," should be put together in three pieces, like the templet shown in Figs. 99 and 103. It is best to make two of these pieces, one for each side. This will make a little less work for the moulder, and consequently (?) will make a better core. At any rate, the core maker won't have so many corners to trim off, or forget to trim off.

The manner of laying out the "half" moons, and also the "wings," is fully described in



Globe Valve Patterns.

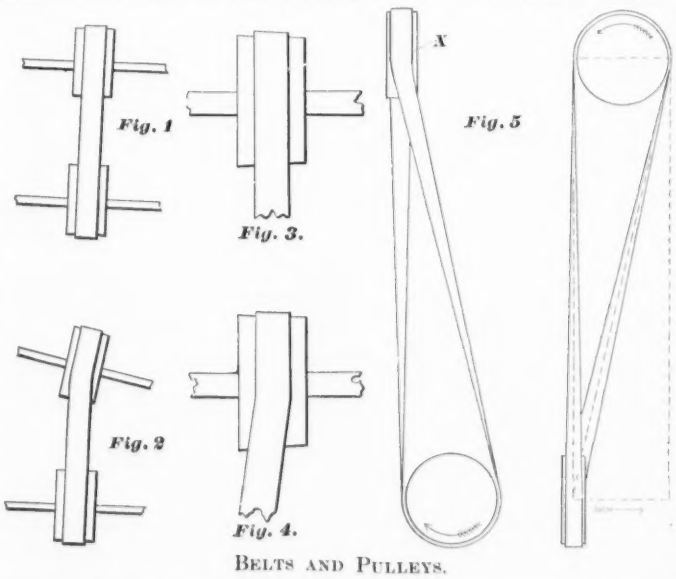
the American Machinist, Aug. 28, 1886, page 3. To this description it is necessary to add the manner of fitting them into the box, and also show how they may be held in their places while the cores are being made.

The half-moon must be fitted into place first. The center of box was marked while in the lathe. We shall have to locate the center of thickness of half-moon by measuring from the center of yoke end on the line of circle marking the circumference of body of valve; to do this, put a piece of stuff from the end of print on yoke end across to the opposite side of box. On this we can first find the center of ball, then mark the circle across the piece of stuff, then locate the center of yoke end on this circle. Now we must also mark a point on the opposite side of box, which will be in line with the center line of yoke end. And as the center of ball is also on this line we have found two points on the circle of body which are exactly opposite each other, and also in line with the yoke end. We will now lay off from these two points the position of the ends of half-moons, marking the point which is the center of their thickness. We now have five points fixed, four around the circumference of box and one in the bottom; from each of these points lay off half the thickness of half-moon each way, adding to the actual thickness enough to form a fillet on each side. Now take the templet used in forming the inside of box, make one side perfectly flat, that it may be used as a straight-edge to mark the lines around the inside surface of ball. As we have three points located in each one of these lines, we shall have no trouble in making them straight. Cut the space between these lines down about $\frac{1}{4}$" below surface of box, thus forming two continuous grooves down across the surface, intersecting each other at the bottom center of ball, and forming equal angles with a line drawn through the centers of two side branches. The depth of these grooves may be gauged by a router, if you will substitute a wooden plate fitted to the inner surface of core-box for the usual flat plate.

These grooves form pockets to receive the half-moons, and will hold them firmly in their places. The half-moons may be fastened on a face-plate, and turned, fillets and all, to fit in the box. They should have plenty of draft on each side, so that the core will come out clean. Now cut them out to receive the wings, and fasten them in the box by a screw through each end.

The pieces for wings should first be cut into quarters and then fitted together on a face-plate, so that the joints shall intersect at the center, and each piece contain an arc of 90°. Then, after they are turned, they will all be alike. To fasten these pieces in the box, so as to hold them firmly and still allow them to be drawn out of the core, is the problem now presented. The upper edges are held strongly, by means of a cross-bar of hard wood, screwed firmly to the wing, and then fastened to the box by a machine screw at each end, tapped into a metal plate, which in turn is let into the top of box and fastened securely by long screws. This way of fastening brings them always to the exact position, the screws acting as dowels, and holding them securely. The usual manner of fastening the lower corners is by means of a pin fast in the half-moon at the center of box, and projecting upward into the joint between each pair of wings. This will not, as a rule, give very satisfactory results, and I will try to explain a much better way of holding these points in place.

If you will look down into the core-box after the wings are in position, you will see that the round corner made on wings at *b*, Fig. 96, leaves a three-sided space between the top edge of half-moon and the wing pieces. There will be one of these spaces under each wing, and they will be on opposite sides of the half-moon with each pair of wings. These spaces afford what I consider the best possible way of fastening or holding the wings at their lower corners, and which I will try to explain.



Belts and Pulleys.

Note how far this space extends each way from the center, then remove the wings and cut from the top edge of half-moon, $\frac{1}{4}$" in depth for a distance each way from the center, a little greater than was the space left between wing and half-moon, cut both half-moons and then fit into each gap a piece that will bring the half-moons back to their original form; fasten these pieces by a small screw at each end. Now put the wings back in box, first fitting a dowel into one half, and making a hole to match it in its mate; this will prevent them from shifting by each other, and leaving a shoulder or "overshut" on the valve seat. Screw the wings down into their places, then fit pieces of wood into the three-sided places already noticed, and fasten them to the pieces let into the upper edge of the half-moons.

Take out the wings and the half-moons, and dress off the pieces just fitted to the surface of the half-moon on each side, then remove the little screws, and we have a piece the shape of which would be rather difficult to describe. This is to be sand-papered and varnished, and used as a pattern to get castings from, which, when fastened to the half-moons, will hold the lower corner of wing pieces firmly in just the right place.

For the angle valve we will of course leave out the half-moons and wing pieces, and put in the seat shown in Fig. 97.

We have now constructed what I consider a very excellent pattern and core-box for making either a globe or angle valve of this size. It is a durable pattern, and one that will compare very favorably in cost with any pattern made for the same purpose.

About Belts and Pulleys.

By Frank H. Richards.

SECOND PAPER.

In the sketch, Fig. 1, we have two parallel shafts, with a plain pulley on each, and a straight belt connecting them. There is no apparent reason why the belt should not continue to run in the center of the pulleys. If, now, we throw one shaft out of line, as exaggerated in Fig. 2, leaving the belt still leading squarely from the pulley on the other shaft, no explanation is needed to show the way the belt will go. It is evident that, whichever way the shaft is turned, the part of the belt approaching the pulley will continually lead upon the pulley further to the right, or towards the near ends of the shafts, until it runs off the pulley. As soon as it has begun to move sidewise upon the one pulley it no longer leads squarely back to the other pulley, but approaches it at an angle which makes it begin to run off that pulley also. Of course the operation is precisely the same, if slower in its effects, where the shafts are but slightly out of line.

In Fig. 3 we have a straight belt upon a conical pulley. As the pulley turns the larger diameter, involving also a larger circumference, at each revolution carries that edge of the belt faster and farther than the other edge, until the belt assumes upon the pulley the position of Fig. 4; and when it lies upon the pulley like that, it is easy to see that it will lead itself toward the larger end of the pulley, and so continue to do. The common crowning-faced pulley may be regarded as made of two cones, or frustrums of cones, placed base to base, and a belt running upon it may be regarded as two belts, one upon each cone and both crowding toward the center. When, from any cause, the belt gets to either side of the center there is a greater width of the belt upon that cone, and consequently it is able to push toward the center harder than the other side of the belt can push, and in this way the constant tendency is to restore the belt to the center of the pulley. The crowding of the two edges of belt toward the center is often evidenced by its injurious effect upon wide, heavy belts. I knew a 24" double belt ruined by it. The constant crowding made the belt buckle and double up and tear down through the middle, so that it had to be replaced before it had served out half its days. Pulleys carrying wide belts should have no more crown than is necessary, and the crown need only be upon one of the pulleys. I know they are saying now that belts can be run upon straight-faced pulleys. It seems to me that to do so requires such absolute perfection in all particulars that it may be said to be impracticable, if not impossible. I have seen lots of "fun" with carrier pulleys. Such pulleys should never be made with a crowning face. When they have a straight face they can be made to lead the belt to either side by moving one side or the other in a line parallel with the belt, and not at right angles with it.

When either side of the pulley is advanced in the direction in which the belt is moving, the tendency is to send the belt toward the other side. Where a carrier is fixed it works admirably if made with a decidedly concave face. This was news to me, and I would gladly credit the source of my knowledge, only that circumstances with which I need

not trouble the readers of the AMERICAN MACHINIST render it impossible. If it is desirable to adjust the belt edgewise by means of the carrier, the straight-faced pulley should be used.

The practice does not seem to be settled as to the use of tight and loose pulleys, whether their faces shall be straight or crowning. The belt is shipped more readily and easily from and to the straight-faced pulleys, and such pulleys should be used, especially where the shipping of the belt is frequent. When a machine is to run all day or for a long time without stopping, it might be well to have the pulley slightly crowning, so that the belt will not chafe the shipper. The vilest of practices that I know of in connection with tight and loose pulleys is that of making the loose pulley smaller in diameter than the tight. The reason alleged for it is that it relieves the belt by making it slacker when upon the loose pulley. The relief to the belt is not appreciable. The damage to the belt in forcing it up over the edge of the tight pulley is inevitable. That edge of the belt is stretched out, and the belt is made crooked. Often where a machine starts hard and slowly the edge of the belt is burnt from this cause.

Quarter-twist belts should be long and narrow, *and few*. They always work at a disadvantage, and should be avoided where it is possible. He would be a peculiar mechanic who would put one in where it was not very necessary. I have known it done so that a man could exhibit his "mechanical ability" in that way. So I can imagine a pilot would boast of taking a ship in by a tortuous and difficult channel when there was clear sailing by a shorter route. With a quarter-twist belt one edge of it is necessarily tighter than the other. A belt running as in the sketch, Fig. 5, will be found to bag out away from the pulley at *X*, and at the corresponding point upon the other pulley. This slackness is upon the same edge of the belt, both going up and going down. It has been suggested to me that some of this could be compensated for by making the pulley conical, the larger side of the pulley running with the slack edge of the belt. It is difficult to see how this would help matters. The larger diameter and increased travel of surface would take up the slack in the straight part of the belt, but it would accumulate more slackness at *X*. To reverse the cone, making the belt tighter at the edge where it is already tightest, does not seem to be a promising operation. It is evident that pulleys for a quarter-twist belt need not be crowning to make the belt lead right, as that is determined by the departure from the other pulley, and with the crowning face the slack edge of the belt is only so much slacker. I think until further notice pulleys for quarter-twist belts shall be turned straight face. I use the term straight face rather than flat face, which is common, because the pulley is straight, just as any cylindrical surface is straight; there is nothing flat about it. The quarter-twist belt causes some end thrust upon the shaft, mostly upon the driven shaft; and this thrust endwise should be provided for by suitable collars properly oiled. Where a horizontal shaft drives a vertical, the belt, if possible, should be placed to lift the shaft rather than to pull downward. The pull of the belt being known by the amount of power transmitted, the thrust upon the shaft will be that portion of it represented by the short side of the parallelogram of which the pulling belt is the diagonal. In the sketch this end thrust would be nearly all in the lower shaft, in the direction indicated. Whatever end thrust occurred to the upper shaft would be from the excess of belt tension over the driving pull. The proportion of belt surface to the power transmitted should be larger with a quarter-twist than with a straight belt, and the belt should not be slack, because all slip tends to move it edgewise off the pulley. A quarter-twist belt, after running a while, will be found to be permanently elongated upon one edge, and if it breaks or is taken off for any reason, should be replaced in the same position.

The rule I carry for hastily approximating the power transmitted by belts is 1,000 feet of belt 1 inch wide per minute per horse-power. This gives a very liberal allowance of belt.

LETTERS FROM PRACTICAL MEN.

About Reamers.

Editor American Machinist:

In a recent issue of the AMERICAN MACHINIST, Mr. Richards and Mr. Beach give their experience with reamers, which agrees with my own, with a few exceptions. I have often wondered what the plan of others was for keeping reamers to their proper size, since I have seen very little written on this subject. No one but those who are particular about having exact sizes of holes, with a view to interchangeability of parts, knows what an annoyance it is to have reamers wear below size, and then to get at a cheap method of correcting them.

Mr. Richards' plan I have had no experience with, but think it will no doubt do the work; that is, the use of the roller; but as to how often that operation can be repeated on the same reamer, I do not know. I should judge not very often.

The plan of turning each reamer down to the next size does not appear to be the right thing to do in all cases, unless all reamers in use are equally used, and would wear down together, so that when one is changed they all would be changed, thus keeping a full set, and only requiring the replacing of the largest size. But it often occurs that one reamer is used very much more than the rest, and wears below size long before any others. In this case, enlarging the reamer would be the best plan.

I will give a plan that I have used with very good success for enlarging reamers above one inch in diameter, which, by providing a little convenience for doing, can be cheaply done. After a reamer is worn down I anneal it, chuck in the back rest of a lathe (being sure first that a true surface is had on the reamer shank an inch or two back of the reamer portion on which to put the rest). I then bore a hole of a suitable size to some little distance beyond the reamer portion, it being best to have it taper as shown in the drawing, Fig. 1. Then, by making a plug of same taper and heating the reamer, drive the plug into the end just sufficient to expand it a little more than the amount it is worn, then, by jarring the plug by striking the sides immediately after expanding the reamer, it will drop out. Then re-harden the reamer, which can now be done without any risk of cracking off the teeth, the required hardness being had without a very high heat.

The reason for boring the hole beyond the fluted portion is to avoid cracking off the whole end of the reamer in tempering, as is the case if any tempering is done at the bottom of a hole. Now I put the reamer in the back rest of the grinding machine (a thing that no grinding machine should be without), hold the reamer back in the head stock center by a convenient means, and grind to size.

When this reamer gets below size again, it can be quickly enlarged, and this can be done a great many times. Using a plug and simply driving it with a hammer presents some objections, unless it is done with great care, as it may be driven out of square, and the reamer may be expanded a great deal more than is necessary. This can all be overcome by making a simple press, something like the sketch, Fig. 2, in which the reamer is firmly held on a line with the plug, which can be operated by a screw, which would serve as well for extracting the plug, and also give a definite idea of the amount of expanding done; this will leave the reamer true, and give the least possible amount to grind off.

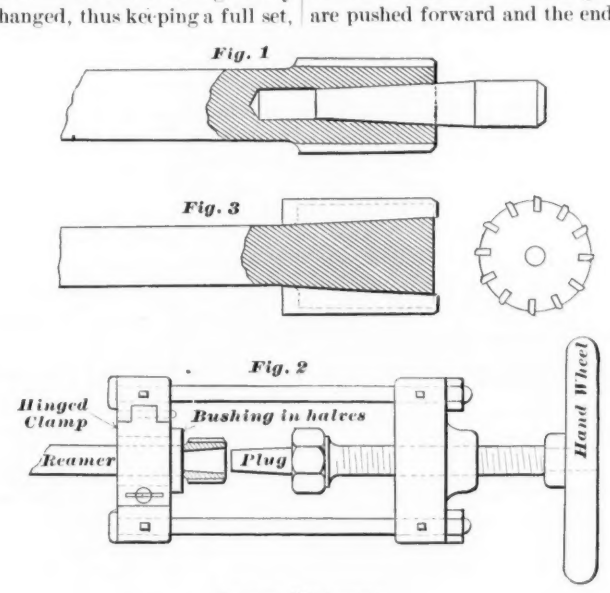
The inserted tooth reamers, as shown by Mr. Beach, afford a very desirable means of keeping to size, as, by this method, annealing and re-hardening are entirely obviated. I have made some large reamers on this plan, and find them very satisfactory to keep to size. Another trouble is obviated, and that is, the cracking and flying off of the teeth, which is a very common occurrence in hardening with large, solid reamers. I make my inserted tooth reamers as shown in Fig. 3, with the deepest part of the groove back. This is done to keep the cutting edges ahead of the body of the reamer, so that not so much room is required between the work and the chuck or face plate of the lathe. As the reamer needs enlarging the cutters are pushed forward and the ends ground off, which will also keep the cutting edges about one width.

I believe that irregular spacing of teeth on reamers is not essential if the cutting edges are properly made. I have seen reamers irregularly spaced, making chattered work as well as regularly spaced ones, and smooth work from both. Irregular spacing simply puts the reamer in the same condition as a regularly spaced one would be with many times more teeth in it. I do not mean to claim that irregular spaced teeth in reamer has any disadvantage in their use; to the contrary, they seem to have advantages theoretically in respect to chattering, but my experience in practice shows the advantages practically nothing, as I always have succeeded in doing equally good work with regularly spaced teeth.

Mr. Richards' plan of irregular spacing is a very good one in some respects, but with that kind of spacing the reamer is put into such shape that it cannot be measured by the ordinary means. Manufacturers of reamers who make irregular spacing, make a certain irregular spacing for one-half of the circumference, and the same thing for the other half, thus making one tooth always opposite another. By this method the reamer can always be measured by the ordinary means. By Mr. Richards' method you must have a solid standard collar gauge for the purpose of gauging, and a great many sizes, and even then, if any variation exists, he cannot tell how much that variation is. The same trouble also exists in putting an odd number of teeth in the reamer, although evenly spaced.

Therefore I consider an even number of teeth, regularly spaced, with the proper cutting edge, in practice equally as good as the other, and in respect to making and keeping them in order, very much better.

A. B. LANDIS.



ABOUT REAMERS.

"Boiler Studs."

Editor American Machinist:

Being a constant reader of your paper, I find a great deal of valuable and interesting matter in it to study. In your issue of August 18 I find an article on "Boiler Studs," by A. B. Landis. This is so important a matter that it seems to me no one can fail to appreciate it who has anything to do with steam boilers. I wish to speak of what I consider one important item that Mr. Landis seems to have overlooked. It is this: before the workman can commence to remove a tap bolt from a boiler that is under steam pressure, the steam, and sometimes the water, must all be blown out, thereby consuming a great deal of valuable time, for the boiler must be allowed to cool off sufficiently before filling again with cold water, or else leaky tubes and seams will be the result of too much haste in filling again.

To-day I have not a single tap bolt in our whole boiler construction (outside), for I am satisfied that studs are infinitely better than tap bolts.

R. D. SUTHERLAND.

Boston, Mass.

Flaws in Steel.

Editor American Machinist:

In reply to a communication in a recent issue of the AMERICAN MACHINIST about longitudinal cracks in steel, I take the liberty to inform the gentleman what the trouble is. The steel is simply piped. It is caused by hammering steel too cold under the trip or steam hammers, and sometimes by a flaw in the ingot. I have quite frequently seen it in small taps where they have been forged from large steel down to small sizes, and some smiths are liable to hammer a piece of cast steel too cold, especially under a trip hammer. It will crack in the center almost every time.

THOS. L. SHERMAN,
Foreman Smith Shop H. B. Smith Machine Co., Smithville, N. J.

Long and Short Screw-Drivers.

Editor American Machinist:

Every young person, when entering upon his apprentic hip, finds in the shop some perplexing questions whose discussion is interminable. In the foundry it is the relative weights of solid and molten iron, in the machine shop the best form of cutting tools, etc., and in the pattern shop the most prominent is the screw-driver question. In my early experience in the pattern shop I was beset with this perplexity, and devoted no little time to its solution. With screw-drivers of various lengths, a spring balance, etc., I improvised experiments which soon satisfied me—what every educated mechanic must know, viz.—that a long or short screw-driver will not transmit more force than is applied to it. Notwithstanding this incontrovertible fact, all persons who have frequent use for screw-drivers are conscious that they can drive or back a screw with a driver thirty inches long that they could not do with one fifteen inches long.

In a shop where the usual bench screw-driver was one about fifteen inches long, and where screws from four to six inches were frequently used, for which the men had special drivers about thirty inches, I have often observed a man trying to drive or back one of those large screws with his short driver. After nearly exhausting himself in the vain endeavor to back an obstinate screw with his short driver, he would lay it down, go to his chest for the longer one, which, on applying to the screw, it would come out without apparent difficulty. If the observation of the above circumstances is critical, the operator will be observed to first assume one position and then another; finally he gets into that position where the force is most advantageously applied, and the driver most efficiently transmits it; and herein lies the explanation of why a person with a long screw-driver can accomplish what seems impossible for him to do with a shorter one.

The advantageous adjustment of the body and driver is more restricted in the shorter screw-driver.

The animal force applied to a screw-driver is expended in two directions; first, to prevent the point coming out of the slot, which it is prone to do in consequence of its taper; second, in turning the screw a great deal more force may be expended in the former than is necessary, and as the effort applied is definite according to the individual, in such case, there will be less available for the more important object of turning the screw. A long screw-driver will have increased weight, and when applied vertically will relieve the effort to keep it in the slot to that extent.

Another fallacy connected with screw-drivers is the shape of the handle. About the only reason I can see for flattening the sides of the handle is that the inventor of the instrument made them that way. With a round handle a grip may be maintained by an individual against any effort he may apply to turn a screw; and, moreover, the relative positions of the handle and operator are immaterial; furthermore, the round handle is more comfortable.

I once handled a set of screw-drivers for a friend. As I had been painstaking to polish and make them look nice, I was not a little grieved at the disappointed manner in which they were received. I soon learned that the cause was the form of the handles; so, to please him, I flattened the sides, though confident he would regret it, as I knew he had frequent use for the larger one. Some time after he came to me with sore hands and apologetic manner, saying he deserved to be kicked for having those handles flattened.

J. McKim Chase.

An Engineer's Reflections.

Editor American Machinist:

I believe it is quite a common thing among moulders and machinists to throw up a situation where they find the shop, tools and foreman relics of antiquity; and the reason assigned is the fear of losing their skill, and of being corrupted by bad mechanical surroundings. More or less, this principle runs through all trades, but right here I want to say that the stationary engineer should be exempt from this.

There are many model steam plants now—plants where the boiler, engine, heater and pump are as near perfection as possible at this time, and happy is the man who is in charge, at least in the estimation of those engineers who labor under this or that disadvantage. But if Jones, at the planing mill, should quit just because he knew he was as capable as the engineer at the model plant, he would be acting absurdly. Engines must be run, and if the proprietor won't fix this or that, it must go anyway. He may not tell you nor me, but every time he pays the coal bill he blesses the man who sold him the plant. Within certain limits the work don't lie with the proprietor, but with you, and one year's experience with an overloaded engine or boiler is of more value in developing you into a thinking, careful, ingenious engineer than ten years at the model plant. If you have been a constant kicker, turn over a new leaf. Don't ask for the moon, but do the best possible with what you have.

There was Brown running for Smith. Well, he quit, and Smith secured Jones. Brown told Jones that Smith would not get him anything, or fix up, and predicted Jones would not stay a month. Jones was young and nervy, and he went down Monday morning and took charge. By and by Smith came out and they had a little talk, and Smith told him that things were not in good shape, but that he hoped to get time after a while, etc., etc. Well, Jones went to work; he put in a damper, scraped the flues, reset the valve, set out the packing, cleaned the soot off the shell of the boiler, and—well, it would take a page to tell all he did, without costing Smith anything; and, as the coal bill fell away, a smile came on Smith's face, a substantial reflection of which went into Jones' pocket. Now this is not overdrawn one bit. But the moral is what we are after. An engineer should scrupulously and conscientiously take care of a plant under all circumstances. He should disregard no duties, however unpleasant, but strive to overcome the difficulties by his ingenuity, bearing in mind his own development and reputation. You and I are running with the constant aim of getting a horse-power (under bad conditions) out of the least possible amount of coal. Put the proprietor out of the question and place yourself first, remembering that the main thought is to develop yourself, and that can be done in less time, and more completely, with an ordinary plant than at the model plant.

Thos. T. Parker.

A Long Line Shaft.

Editor American Machinist:

Your notice of the Cincinnati Exposition, in issue of Sept. 1st, notes what "is said to be the longest continuous line of shafting ever run in this country." We recently placed one of our compound engines at Pompton, N. J., about in the middle of a line of shafting 2,300 feet long, being coupled to both ends of engine shaft. This is *only* 1,400 feet longer than the east line shaft of Power Hall, Cincinnati.

Wm. Coutie & Son.

Troy, N. Y.

Machinery at the Cincinnati Centennial Exposition.

The machinery hall at Cincinnati is well arranged for the exhibition of machinery; it is very large, well lighted, both naturally and artificially, and at night especially puts on a very brilliant appearance. Commencing at the north end of the building, there is first a number of exhibits designed to show the methods of manufacture of various articles, such as bar soap, mineral waters, etc., which, though they seem to attract considerable curious attention from visitors, are of no special interest to the mechanic. Among these, the one which seems to attract most attention, judging from the crowds which are almost constantly before it, is the advertising device of a brewery, and consists of a painted imitation of the buildings, and some of the surrounding features, and has small painted railroad trains, street cars, beer wagons, bicyclists and steamboats, all constantly appearing at the left and moving towards the brewery with that indescribably peculiar and distressingly unnatural motion always seen in such toys. It amounts to nothing, but apparently attracts more attention than the finest piece of mechanism in the hall, and, of course, thereby serves the purpose for which it is exhibited.

Charles R. Barnes & Co., of Cincinnati, show a high-speed self-contained engine, with overhanging cylinder and throttling governor. It is used for running a number of electric dynamos.

The John H. McGowan Co., Cincinnati, have quite a display of steam pumps of various kinds, there being about sixty pumps of their manufacture on exhibition, the new features among them being a new design of brewer's air pump, and a new arrangement of valve levers for duplex pumps, designed to facilitate the regulation of the length of stroke, and to secure uniformity of action. Some of their pumps have a vacuum chamber inside the air chamber, and connected with the suction pipe; this, besides serving other purposes, fills up with water when the pump is stopped, and there is thus no necessity for priming when it is again started.

The Gordon Steam Pump Co., of Hamilton, Ohio, have eight of their pumps of various kinds on exhibition; among them the largest pump to be seen there. It is a duplex, compound, non-condensing pump for water-works service, with a capacity of one and a quarter million gallons. Among the others is a duplex for deep mine pumping, designed for high-water pressure, and with a capacity of 900 gallons per minute. They also show a new pattern of boiler-feeding pump, duplex, with interchangeable cylinders, and a brewer's air pump, also duplex, with cranks and fly wheel and an automatic governor, which controls the motion of the pump according to the pressure of air in the delivery pipe, stopping it when the desired pressure is reached.

The Laidlaw & Dunn Co., of Cincinnati, have a Worthington duplex pump and various forms of hydraulic presses used in tobacco manufacturing, the back wall of their section being taken up with a very fine display of the Ashcroft Mfg. Co.'s gauges, revolution counters, etc. Two of their pumps are in use pumping the water for the cascade in floral hall, which has been previously mentioned.

The Eclipse Pump Mfg. Co., Cincinnati, show two pumps of the Worthington Duplex type, two others having steam actuated valves; and a new boiler-feeding pump.

Weber Bros. & Co. show in practical operation a new belt holder, which consists of two segments, together equal to about one-half the circumference of the pulley, which they equal in radius. They are supported at the ends of arms which are supported by a sleeve bearing upon the shaft. The segments not forming a complete circle, the tension of the belt is released when it is run onto them.

J. M. Robinson & Co., Cincinnati, show various presses for light work, for hand and power, and intended chiefly for tin shops and cornice makers.

Sebastian, May & Co., Cincinnati, show several small lathes, some with foot motion and others with countershaft for power.

The Cordesman Machine Co., Cincinnati, have a band saw at work sawing out the various fancy and curious articles which are always so popular at such exhibitions, and show also a carving machine for decorative work, and, what is called a "twist machine," which is something new and quite interesting. It is for producing the spiral flutes upon parts of furniture and other wood work now so popular, and may be called a universal spiral machine, reminding one of the Universal Milling Machine, from which it differs in construction, of course, but its principle of action is similar. The spindle which carries the cutters is vertical, having the cutter head at its lower extremity. There is a pair of centers, between which the work is placed and indexed for the proper number of flutes, while by means of gears connecting the indexing spindle with a stationary rack, the work is revolved upon the centers as the slide upon which they are mounted is fed along. The head which carries the spindle can be inclined to the right or left to the angle suitable for the spiral to be cut, which may be from $1\frac{1}{2}$ to $10\frac{1}{2}$ inches pitch. Back of the slide which carries the centers and the work, provision is made for fastening two forms, which may be made of wood, and which control the distance between the center of the work and the cutters, and the position of the work relative to the cutters, in such a way that a piece of almost any shape may be cut spirally, whether it be a simple taper, double taper (smallest at each end), or a curve of any form, single or double.

They also show a double spindle horizontal boring machine for wood workers, the spindles of which can be set so that the line joining their centers will be at any desired angle from a horizontal to a perpendicular; or, in other words, the spindles may be side by side, or one may be vertically over the other, or in any intermediate position, and the distance between the spindles is also adjustable, so that holes may be bored two at a time at any desired distance from each other, measured at any desired angle with the sides of the piece operated upon.

The Egan Co., Cincinnati, exhibit some fifteen machines for various purposes of wood-working, including some very heavy ones for car builders and a new automatic knife grinder. They show an attachment which may be used on a universal wood-worker, frizzer, or similar machine, for making rope moulding. It is for straight work only (not tapering), and makes it in pieces of any length for which the material can be had. They also exhibit an improved Blanchard spoke lathe, which is by recent improvements rendered nearly automatic in its action, requiring only that the work be put in and taken out by the operator.

Greenlee Bros. & Co., Chicago, Ill., show some very good wood-working machinery, including self-feed rip-saws, special sash and blind machines, etc., one of the most novel machines of the exhibition being their "hollow chisel mortising machine." This machine has a horizontal spindle, which is moved to and from the work automatically in regular strokes, similar to the action of a shaper, and carries a bit or auger, which bores into the work at each stroke a predetermined depth, which is adjustable at will. This bit revolves in the center of a square hollow chisel, which, as the bit cuts its way into the wood, cuts away the corners and makes the hole square; the bit removing the chips made by the chisel as well as its own chips and throwing them all out of suitable openings made in the chisel further up from the edge. The piece to be mortised is clamped upon a table, which is movable by a lever or hand-wheel to the right or left against adjustable stops. The frame which carries the spindle is at the same time movable vertically to adjustable stops, by means of a lever, and thus cuts a square or rectangular mortise of any desired proportions. Two sizes are shown, and they seem to be very efficient machines, attracting considerable attention.

Post & Co., Cincinnati, in addition to their display in the Park building of specialties manufactured by them, show in machinery hall a large variety of machine tools for which they are the agents. Among them are a number of milling machines of various sizes and kinds made by E. E. Garvin & Co., New York, most of which are familiar to our readers, having been illustrated in our columns. There is also an upright tapping machine made by the same firm, a profiling machine, and a multiple spindle drill having six spindles and a table elevated and held at any desired height by means of a worm and worm-wheel which are connected by a steel rope to the table; also a tool grinder of improved construction, having an attachment for surface grinding. It consists of a cross slide, carrying a chuck and having a rapid motion by means of gears and a rack, instead of by a screw. They also show a complete line of emery grinding machinery made by the Diamond Machine Co., of Providence, R. I. including ordinary grinding frames for general purposes, a tool grinder, knife grinder for planer knives, drill grinder, die grinder, and a machine for grinding cylindrical or taper work upon centers. They also show a double spindle sensitive drill by the Sigourney Tool Co., of Hartford, Ct., some heavy drill presses by the Bickford Drill Co., of Cincinnati, bolt machinery by the Acme Machinery Co., of Cleveland, a nut-finishing machine by Nicholson & Waterman, Providence, R. I., which we illustrated in our issue of Sept. 24, 1887, shapers by Gould & Eberhardt, of Newark, N. J., and by Geo. Wolcott & Son, of Jackson, Mich., a lathe and screw machine by the American Tool and Machinery Co., of Boston, and other tools.

The G. A. Gray Co., Cincinnati, have on exhibition three of their planers, which are of the design familiar to our readers, except that the smallest has a new form of cam for belt shifting, which oscillates about a center, instead of having a rectilinear motion. The large one has two heads and mechanism for elevating the cross-rail by power. They also show three of their lathes, engravings of which have appeared in our columns.

Lodge, Davis & Co., Cincinnati, show a complete line of the machine tools built by them, including drill presses of various sizes, from 15″ to 32″, lathes from 17″ to 38″, shapers from 15″ to 32″, a line of brass workers' lathes, cabinet turret lathes, and turret-head boring or chucking machines of various sizes. Most of the tools have been illustrated in our columns from time to time, the new features noticed among them being an automatic stop for the feed of their drill presses, which can be set by means of a graduated scale to throw the feed out at any desired depth; and some new features on their largest lathe, (the 38″) which, instead of having a taper attachment, has a compound rest with automatic feed.

The Niles Tool Works, Hamilton, O., have a very good exhibit of their well-known tools, including lathes, planers, radial drills, a car-axle lathe, car-wheel press,

heavy horizontal boring machine, slotting machine, a new upright turret-head boring machine, and other tools. The last named machine has been recently designed by them, and has a horizontal face-plate and vertical slide, counterbalanced and carrying a turret having four holes for drills, boring bars, reamers, etc. It swings 30″ diameter and has five speeds. One of their planers is also newly designed, being increased in weight and strength, and provided with new feed motion, which is positive during the feed and is released so as to be practically without friction during the continuance of the stroke. The slotted disk to which the feed-rod is attached also contains a new feature for the adjustment of the feed. At one side of the T-slot which passes across the face of the disk is a small rack with which a small pinion engages, this pinion being on the end of a stud which passes through the one upon which the end of the feed-rod is journaled, and is turned by a milled head to adjust the feed.

The Universal Radial Drill Company, Cincinnati, have five of their radial drills on exhibition, of various sizes and designs, and a line of small bench drills. They show also a new brass workers' lathe, which has some features of interest. There is an internal gear, which serves the purpose of a back-gear, and can be thrown in or out without stopping the machine, yet is not a friction clutch, but drives positively either way. This is affected by a double sun and planet motion, which is within the cone pulley and entirely concealed. The clutch which changes the motion is double-ended, and carries a gear wheel with which the two opposing gears of the sun and planet motion engage. When the clutch is thrown one way, it, with its gear, revolves, and all the gears and the cone pulley revolve together; when thrown the other way the clutch and its gear are held still, and the slow motion is obtained, derived from the action of the gears.

Another notable feature of the lathe is in the chasing device, which is so arranged that one large hob, having four threads to the inch, placed on the end of the spindle, and revolving at a constant speed, is made to cut threads of any desired pitch, from five to eighteen threads per inch, including any fractional thread. This is accomplished by the use of a lever of peculiar construction, having a graduated slot in which a stud can be clamped in any desired position, its position in the slot determining the pitch of the thread to be cut.

The Cincinnati Screw and Tap Company have a case showing a fine assortment of the small tools made by them, and also show three of their universal milling machines differently arranged for various kinds of work, including rack cutting by a special attachment, gear cutting and spiral milling.

The Long & Allstatter Co., Hamilton, O., show twelve of their machines of various patterns and for different purposes, including heavy punching and shearing machines, boiler plate shears, double angle shears, plate-splitting shears, tire-welding machine, and a machine for bending plow beams, wagon irons, or other things requiring a machine of considerable power and strength.

The National Machinery Co., of Tiffin, Ohio, show a wire nail machine and some heavy nut and bolt-threading machinery.

The Obermayer Foundry Supply Company, Cincinnati, have on exhibition some ornamental castings made by the use of their facings, two of which have been nickel-plated and the third left just as it came from the mould; they are remarkably fine, and reflect great credit upon their maker, as well as showing the quality of the facing used. The company show a full line of foundrymen's supplies, including testing and other machines made by Rehlé Bros, of Philadelphia.

The Falls Rivet and Machine Co., of Cuyahoga Falls, Ohio, show some of their steel-rim pulleys, solid and split, and their friction clutch pulley, the principal display of the latter, however, being in the dynamo room in the Park building, as referred to last week. There are several displays of leather and other belting, the most notable being by Post & Co., who have a locomotive engine constructed entirely of leather belting, the wheels, which are kept constantly in motion, being composed of rolls of belting, and even the smoke coming from the stack being made of a curl of 2″ belting. It is quite an ingenious idea, and attracts considerable attention. In this space they show some vulcanite emery wheels, one of which is claimed to be the largest emery wheel ever made: it is 48″ diameter, 6″ thick, with an iron center 28″ diameter.

The Ritchie & Dyer Co., Hamilton, Ohio, show one of their traction or road engines, and an improved saw-mill head block. Traction engines are also shown by Russell & Co., of Massillon, Ohio, Aultman, Taylor & Co., Mansfield, Ohio, and the Springfield Engine and Thresher Co., Springfield, Ohio. Russell & Co. have with their exhibit a threshing machine of their manufacture which was purchased by General Grant at the close of the war and used for some time on his farm near St. Louis. None of the traction engines are under steam, but they all show a remarkable progress in that line of machinery, and appear to be very efficient, well-designed and well-built machines for the purpose intended. The first named firm build them with a small crane attached, so that a weight not exceeding two tons may be picked up and carried about—a feature which adds to their usefulness in general contractors' work, water-works construction, bridge and other building operations. The Springfield Engine and Thresher Company show some of the more important parts of their engine separately, so that the construction and workmanship can be seen.

The only printing presses shown are by C. B. Cottrell & Sons, of New York. They have four of their presses on exhibition, doing practical work, the largest being a stop cylinder press, with their new front sheet delivery.

There is also considerable machinery for special purposes, shown in operation, such as for weaving silk in various patterns, making whips, woven wire mattresses, etc., which lack of space and time forbid the mention of in detail.

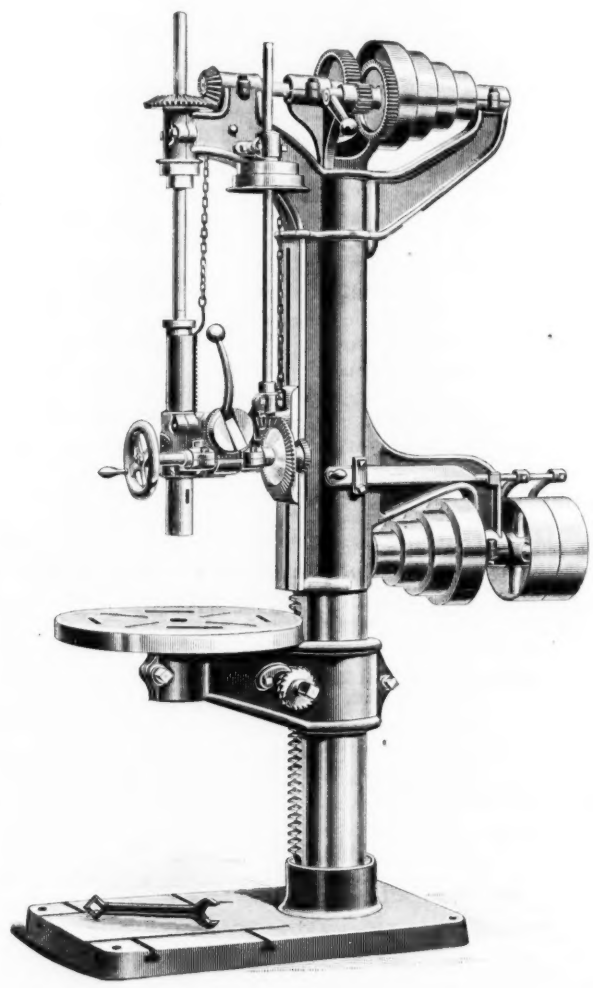
The engines used for driving the shafting in this department are a Lane and Bodley, of Cincinnati, compound Corliss, of 140 horse-power, with Deane's independent condenser; one by the E. & I. Greenwald Co., of the same place, which is of the Brown type; a Vanduzen and Tift (of Cincinnati) gas engine; and a Pittsburgh high-speed engine, built by James Rees, Pittsburgh. In the "old power hall" is a "Hamilton" Corliss."

The Lane and Bodley Corliss, has cylinders 11½ and 20 inches in diameter, by 42 inch stroke, and the governor controls the point of cut-off on both cylinders. There are two wrist plates to each cylinder, one above the other. To the upper ones the steam valve connections are made, and to the lower ones the exhaust valves. Two eccentrics and two rocker arms are used, one for the steam valves, the other for exhaust. The Greenwald engine does not differ essentially from the well-known Brown engine; some change having been made in the arrangement of the steam chest, and an adjustment being provided, by which the cut-off can be equalized while running. This engine is of 200 horse-power.

The Rees engine conforms in general design to other high speed engines, having an overhanging cylinder and disk governor on the crank-shaft, regulating the point of cut-off by shifting the eccentric.

Those interested in flouring mills and machinery for them are attracted by a novelty which is to be seen in the "old power hall" which consists of a complete flour mill, having a capacity of seventy-five barrels of flour daily. It was erected by the Geo. T. Smith Middlings Purifier Co., of Jackson, Mich., its size and proportions being specially adapted for the place in which it stands. It has three stories and basement, stands 42 feet high, and covers a space 27 by 23 feet. It is so made that it can be taken apart for shipment, the floors and framework being of Georgia pine bolted together, and the outside being covered with galvanized iron stamped and painted in imitation of brickwork with brown-stone trimmings. The interior woodwork is of cherry, red oak, whitewood and birch, carved, moulded and polished. It is equipped with the latest and most improved machinery for the manufacture of flour, including six double sets of 7x14 Nordyke & Marmion rolls, two corrugated and four smooth; three special Smith purifiers; one germ aspirator with Prinz dust collectors attached, and two Richmond horizontal bran dusters. These are on the first and second floors. The third (and top) floor contains twelve Smith Centrifugal and Inter-elevator Reels. The arrangement and finish of the mill and machinery is admirable, and it affords a good opportunity to study modern milling operations. The building is lighted throughout by incandescent electric lamps. In a separate building is the elevator, which is equipped with modern machinery for handling and cleaning wheat, and has a capacity of 1,500 bushels.

This building is the same height as the other, and covers a space 10x27 feet; the machinery consisting of a Richmond grain cleaner and separator, Richmond horizontal scourer and polisher, Cranston Huntley & Co. scourer, Hodge, Howell & Co. cockle machine, and two Richmond City flour packers. It is thus seen that it is a very complete mill, and, taken in connection with the superior manner in which all its parts and equipments are finished and the remarkably small space occupied for such a complete mill of its capacity, is of considerable interest.



TWENTY-FOUR INCH DRILL PRESS.

Twenty-four Inch Drill Press.

With this we present an engraving of a drill press recently brought out by the Bickford Drill Co., of Cincinnati, Ohio. In general design and appearance it will be seen to conform to the other well-known machines of its class built by the same company, and to the production of which they devote their exclusive attention. As the engraving shows, it is back-geared, runs a wide belt, has automatic feed and improved quick return. The spindle and movable head are each counterbalanced independently. All gears and the rack are machine-cut, and the makers state that the press has been designed with special reference to quick and easy handling. Further information will be furnished by the makers upon application.

A rich man had a piece of land on which a poor mule was grazing. "I shall harness you," said the man to the mule, "and make you plow this land to grow melons on, of which I am very fond, while the stalks will supply you with food." To which the mule replied: "If I consent to toil on your plan you will have all the melons and I will be worse off than I am now, inasmuch as I will have to eat dry stalks instead of fresh, green grass. I'll not do it, sir." "How unreasonable you are," remonstrated the land owner; "your father never had any food but thistles, and yet worked sixteen hours a day without grumbling." "Alas! that is true," retorted the mule, "but then, you know, my father was an ass."—*Chicago Express.*

We have been favored by Secretary Forney with a copy of the Code of Rules governing the condition of and repairs to freight cars, as revised by the Master Car Builders' Association, at their meeting at Alexandria Bay, N. Y. The rules are published in pocket form, and very well illustrated. A list of defects for which cars may be refused at interchange points is given, and prices for repairs are specified. The names of roads that have adopted the association code of rules are appended.

A small compound engine at the Royal Show at Nottingham, England, has a single cylinder, the area of one side being reduced by means of a trunk. These engines are sold at a low price, and are said to be quite economical in the use of steam.

Manufacturers in Iowa are persistently fighting the railroad corporations for what is said to be discriminating rates against shippers in that State. This discrimination, it is claimed, works against the manufacturing interests of Iowa.

Ninety-pound steel rails have recently been rolled by the Bethlehem (Pa.) Iron Company. There appears to be quite a general movement on the part of railroad companies in the direction of using heavier rails.

AMERICAN MACHINIST

To prevent delays all Communications should be addressed to the Company.

PUBLISHED WEEKLY
BY
American Machinist Publishing Co.
96 Fulton Street, New York.

HORACE B. MILLER, Pres't and Bus. Manager.
LYCURGUS B. MOORE, Treas. and Sec'y.

F. F. HEMENWAY, Editor and Mech. Engineer.
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FRED J. MILLER, }

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☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

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$2.50 a year in advance, postage prepaid in the United States, Canada and Mexico.
$3.50 a year to Other Countries, postage prepaid.

Advertising.

Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

The American News Company,
Publishers' Agents, New York.
The International News Company,
11 BOUVERIE STREET, Fleet Street, LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST, at 14/7 per annum, postage paid.

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NEW YORK, SEPTEMBER 8, 1888.

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The Cincinnati Exposition.

The Centennial Exposition of the Ohio Valley and Central States, now being held at Cincinnati, is attracting considerable attention among the people of the central States, especially among the citizens of "the three States," Ohio, Indiana and Kentucky. The attendance is stated by the officers of the exposition to have been very satisfactory, and the newspapers of Cincinnati speak each morning of the "crowds" and "throngs" in attendance the day previous. Many of the exhibitors, however, express themselves as disappointed in the number of people attending, but all seem to think that, as the huge affair is just now about fully completed, and the cooler and more pleasant part of the season is approaching, the attendance will be largely increased. The space within the buildings over which the people may distribute themselves is very large, and the turnstiles must register the entrance of thousands before the buildings begin to look at all thickly peopled.

It is safe to say that few visitors go away disappointed; there is much there that is of interest, and much that ought to have and probably does have a decided educational value. It affords an excellent opportunity to study the natural resources of Ohio, excellent facilities for such study being provided in the shape of specimens, charts, maps and books. What the people of the State have accomplished by the application of mental and physical labor to those natural resources is well shown in the vast quantities and excellent qualities of the manufactured goods shown, and when it is remembered that this exposition commemorates the one hundredth anniversary of the settlement of that region, and that all this has been accomplished within the comparatively short space of one hundred years, and most of it, indeed, within the lifetime of people now living, the wonder is increased.

Most people, however, are most interested in the Government exhibit, and this feature undoubtedly constitutes the most attractive feature of the exposition. The articles chosen for exhibition seem to have been selected with special reference to their popular interest, and many people are, by means of them, acquiring new and enlarged ideas of the functions and the services performed for them by the Government which they sustain. The average citizen of the interior usually has a very dim conception of the work carried on by the Government, and is apt to think its only object is to pass laws which he don't more than half approve of, and collect exorbitant taxes. A visit to Washington does much to enlarge his ideas about these things, but there are thousands who are kept too busily engaged in the struggle of life to admit of their visiting Washington, and to such the exhibit at Cincinnati is a real boon, which can scarcely fail of accomplishing much genuine good, as well as affording entertainment to people who have paid their share towards the expense of it, but who otherwise could scarcely be made to realize that the money spent in such ways resulted in any direct benefit to them.

It would be far better, however, if the exposition management could be made conscious of the fact that this, the most instructive, interesting and attractive feature of the show, really belongs to the people, and that the exposition management is deeply indebted to the people for the loan of it, and that, as a partial return for this, they should afford the people a little better opportunity of seeing it. There are many who think that the price of admission should be reduced from fifty cents, the present price, to twenty-five cents; but, whether this should be done or not, it certainly does not look right that the people should be charged the former amount each and every time they pass within the gates to look at and to study that which they have themselves provided and paid for, and which belongs to them.

There are thousands of mechanics in Cincinnati and vicinity who would be greatly benefited in many ways by a thorough inspection of the Government exhibit; their only opportunity of doing so is in the evenings, and it would require many evenings to properly inspect this department. Tickets are fifty cents "straight," which, to the average mechanic having a family which he wishes to provide the same diversions for which he himself enjoys, means a practical prohibition of the advantages of the exhibition. This does not seem to be right, and some different arrangement should be made. The people have an undoubted right to demand that that which they have themselves provided should be accessible to them upon the easiest possible terms, and this particular part of the exhibition should be as nearly as possible free during at least a good part of the time.

The machinery exhibition is interesting, and contains a great deal of good machinery, but it speaks more for Cincinnati and vicinity as a manufacturing center of importance than for the ability of the exhibition to tempt exhibitors from a distance, as nearly all the machinery is made in or around the city.

Taken altogether, the exhibition is very creditable, and well worth visiting; but it is not improbable that it marks the climax of such things in Cincinnati, since they cannot have a centennial exhibition every year, and it is difficult to conceive how the people could be induced to take much interest in the ordinary exhibitions such as they have been holding there for years past, after having seen this one.

Why Manufacturers Move.

There is all the time an exodus of manufacturers from older cities to newer cities and towns. These new towns put forth efforts to that end, and they succeed. But there is generally a reason for their success beyond what is offered in the way of bounties and free land; that reason alone seldom influences the removal of an established manufacturing business.

In the older cities there is generally too little consideration for manufacturers, and too heavy a constant burden in the way of taxes. The manufacturer's assets are easily come at for assessment, and with the tax levy up to about the rate of interest that money can be loaned for, and constantly being raised, the handicap becomes too great, and, following the law of self-preservation, he accepts the invitation to locate where the burden will be lighter.

Honesty and good business management in municipal affairs, and an intention to show manufacturers some consideration, will almost invariably hold them where they are established, in spite of bounties. Manufacturers do not object to paying their share of taxes for honest expenditures, but they do object to being outrageously taxed for helping to fill the city with the kind of men who keep the general business of the place moving.

There is in newer towns a greater appreciation of the advantage resulting from the location of manufacture, giving employment to skilled, well-paid labor. The authorities are not given to devising means of taxing them, and placing onerous restrictions upon them to drive them elsewhere.

Railroad Operations.

The effect of railroad operations on the general business of the country is enormous, and sometimes not salutary. On the whole, the general business of the country is enormously increased by railroad construction and operation; but so it is, in fact, by steamboats, or by having good roads.

Under present conditions there is scarcely a business of magnitude that is safe unless based in some way upon the probabilities of railroad building and operating. Shops and factories feel fluctuations in this respect, and they are felt equally by the merchant and the farmer. It is, then, becoming dangerous that so much of the general control of railroad matters is in the hands of speculators, whose aim is to bring about these very fluctuations for speculative purposes. Unsteadiness, in some degree, may be expected in all business, and railroads cannot be expected to be exempt, but general business unsteadiness can usually be predicted and provided for. When, however, a few men have it in their power to unsettle a large percentage of the total business of the country, for no other reason than to unsettle it, the fact of their being able to do so is nothing less than a constant menace.

When a few men hold such power over the general welfare of the country they should use it with great moderation. If more moderation were used we should hear less complaint about railroad monopoly than we do at present. Honest men would see less cause for complaint, and there would be less opportunity for those who talk for the sake of talking, or for a less worthy purpose.

It is foolish to assume that the rights of the people as against railroad corporations shall not be maintained by means of any needed legislation; but if less necessity for such legislation existed, there would be fewer laws enacted that seem intended to injure railroads without benefiting anyone. If there were less of buying legislators by railroad magnates there would be less of organized opposition, and the result would be better for all parties. The finger of Wall street is seen in every department of railroad building and operating, and its influence is such as to tend to build up an opposition that is not likely to stop at the accomplishment of reasonable ends—not likely to stop at anything short of extreme changes. When public opinion is fully aroused, no monopoly can stand against it; but when it comes to that, the voice of the people is not always the voice of wisdom.

The Emory Edwards Fund.

A short time since we published an appeal in behalf of Emory Edwards, the object being to raise the sum of one hundred dollars to place him—now past further work—in an institution where he would be cared for during the remainder of his life. The full amount having been contributed, we have now to request that contributions for that purpose cease. These contributions have come from different parts of this country, and even from England, usually in small sums, from hard-working men. Each contributor has received an acknowledgment from this office; we assumed that they would not desire to have their names published. In behalf of Mr. Edwards, and in our own behalf, we take this opportunity of thanking those who have so generously helped in this matter.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(403) If W. G. F., who inquires as to the taking of apprentices by the Harris-Corliss Engine Company, will write to the company, enclosing a stamp, he will doubtless get the information he is looking for.

(404) I. X. L., Canada, asks: Is kerosene oil good to remove or prevent scale in boilers? Will it injure the iron? And how much should be used in a 25 horse-power boiler? *A.*—Kerosene oil for removing and preventing the formation of scale in boilers is strongly recommended in a paper read by L. F. Lyne, before the American Society of Mechanical Engineers. See AMERICAN MACHINIST, Dec. 17, 1887. We believe it will not injure the boiler if moderately used. We have also some doubt as to the efficiency of kerosene oil in every case, as the character of the water may affect the usefulness of the kerosene. According to the amount of oil used by L. F. Lyne, you would need about half a pint of kerosene oil per day for a 25 horse-power boiler.

(405) F. R., Philadelphia, Pa., writes: Please inform me what pressure an upright copper boiler 8¾ inches high, 5½ inch diameter and ⅛ inch thick, with ten ⅝ inch tubes will safely stand, and what size engine it will run. *A.*—If the boiler is properly made it will stand a pressure of 150 pounds. The tubes are too small, and practically will be of

no service to you. The size of engine will depend on the manner in which you apply the heat. Under favorable circumstances the boiler will probably not develop more than 1-30 horse-power.

(406) W. L. W., Philadelphia, Pa., writes: I saw in your issue of July 7, a rule for computing the safe working pressure of a boiler. Having worked out the following example, and the pressure being so far in excess of what would be allowed in this city, I would like you to inform me if I have applied the rule correctly. Diameter of boiler, 36 inches; thickness of iron, 3/8 inch; tensile strength, 50,000. 50,000 ÷ 6 = 8,333; and 8,333 × .375 = 3,124; and lastly 3,124 ÷ 18 = 173 pounds. *A.*—You have worked out the example correctly. The pressure you have found is that which the board of supervising inspectors of steam vessels will allow in a boiler as given in the example.

(407) J. E. J., Damascus, O., writes: Suppose we have a round tube about 12 inches diameter and 12 inches long, made out of 3/4 material except the bottom, which is 1 inch thick. Now, suppose we enter air pressure at the top through a two-inch pipe and heat the bottom to a low red heat. How much air pressure will it stand without bulging the bottom down? Would the bottom stand continuous pressure at such a heat? Which do you think would stand the best, wrought-iron, cast-iron or steel? *A.*—The behavior of metals under such high temperature has not been sufficiently investigated (at least we do not know of any such investigations) to establish laws upon which calculations can be based. We believe the only way you can obtain the desired information is by experiments.

(408) D. W. H., Fort Washington, Pa., asks: Please give me the diameter and stroke of a cylinder to develop one horse-power with a steam pressure of 60 pounds; the engine is to make 200 revolutions per minute. *A.*—Diameter of cylinder, 2 3/4 inches, 3 1/2 inches stroke; steam to follow about 3/4 of the stroke. There is not a standard ratio between the diameter and the stroke of cylinder, consequently you can make the diameter less and the stroke greater than given, or you may make the diameter greater and the stroke less. 2. Give size of steam ports, length and travel of valve. *A.*—For the size of cylinder here given the steam port should be 1" x 3-16"; lap of valve, 3-16 inch; travel of valve, 3/8 of an inch. 3. Will I increase the horse-power if I increase the area of the steam ports? *A.*—No. 4. Will I decrease the horse-power by decreasing the area of the steam ports? *A.*—The area of the steam ports may be decreased to an extent so as to wire-draw the steam, and thereby prevent the engine from attaining the required speed, and thus reduce the horse-power.

(409) E. P., Philadelphia, Pa., writes: I see it stated that a cubic inch of water evaporated into steam at a pressure of 14.7 pounds would fill a space of 1,644 cubic inches. Does this mean steam at 14.7 pounds, or does it allude to atmospheric pressure? If the latter, what would be the steam pressure? *A.*—The pressure given in the statement to which you refer means one atmosphere pressure. If, for instance, we have a tube whose cross-sectional area is just one square inch, and fill the first inch in depth with water, and on top of this we place a piston whose weight is balanced, and which also works frictionless in the tube, and then heat the water until it is expanded into steam under the ordinary atmospheric pressure, the piston will then have risen, according to the statement in your question, to a height of 1,644 inches. If now a steam gauge be attached to this tube it would not show any pressure. According to Ganot's Physics the weights of equal volumes of steam at 100° Centigrade and water at 0° is 1.698. The practical rule that a cubic inch of water yields a cubic foot of steam, though not quite accurate, expresses the relation in a convenient form. 2. Would not 3,960 cubic inches of steam at 100 pounds pressure constitute a horse-power? *A.*—No.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

See Grant's Gear advt. on back page.

Link-Belting.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link Belt Machinery Co., Chicago and N. Y.

See our new designed engine lathes in Cincinnati Centennial Exposition, Lodge, Davis & Co.

See our new designed drill presses in Cincinnati Centennial Exposition, Lodge, Davis & Co.

See our new designed shapers in Cincinnati Centennial Exposition, Lodge, Davis & Co.

See our new designed brass working tools in Cincinnati Centennial Exposition. Lodge, Davis & Co.

2,000 feet of space in Cincinnati Centennial Exposition, Lodge, Davis & Co.

See special adv't, page 16, Lodge, Davis & Co

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Lamb Knitting Machine Co., Chicopee Falls, Mass.

Machine work and pattern making. Anderson Machine Works, Peekskill, N. Y.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

"Swift" Sight-feed Lubricator: no glass tubes; simple, reliable. Swift Lub'r Co., Elmira, N. Y.

Davis Key-Seating Machines, kept in stock, by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Drawings, mach. patterns and models. Inventors' ideas perfected. Valentine, 15 Alling st., Newark, N.J.

"The Bulldozer," a new departure; forging by pressure. M'f'd by Williams, White & Co., Moline, Ill.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Brown & Sharpe Mfg. Co. have a line of machinery with S. A. Smith, 23 S. Canal st., Chicago, Ill.

Patents—Whittlesey & Wright, 705 8th st., N. W., Washington, D.C. Send for pamphlet and references.

Ice and Refrigerating Machines, 124 built, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill

Engine lathes, hand lathes, fine tools, files and supplies for machinists and other metal workers. Frasse & Co., 92 Park Row, N. Y.

Special electric light for factories; large or small plants. Address The Waterhouse Electric and Manufacturing Co., Hartford, Conn.

Patent Attorney. R. G. DuBois, 916 F st., Washington, D. C. Service at reasonable rates. Send for pamphlet containing list of references.

Machinists' supplies, brass goods, m'f'rs supplies, polishing materials, all kinds wire, metals, etc., in any quantity. Jordan & Gottfried, 208 Canal st., N.Y

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

Fine tools and supplies for machinists and other metalworkers. Get our prices before purchasing elsewhere. Montgomery & Co., 105 Fulton st., N.Y.City.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See Sept. 1, p. 12. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Upright drills, improved, sizes 21", 23", 25", 28", 32", 36" swing; finely made and great capacity; write for cuts and prices. Currier & Snyder, Worcester, Mass.

W. H. Hoffman, consulting engineer, 108 Liberty st., room 3, N. Y. Mechanical engineering in all its branches; working drawings for the transmission of power by steam, water, air and electricity.

Contract work of all kinds executed promptly and on reasonable terms. Parties wishing gray iron castings in large quantities can make money by corresponding with Rawson Mfg. Co., Hornellsville, N.Y.

A system of easy lettering by J. H. Cromwell, giving 26 forms of alphabets. The space to be lettered being divided into squares; simple and effective. Price 50 cents. Catalogue of books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N.Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, the full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

The series of articles by J. G. A. Meyer, on "Practical Drawing," now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including August 11, 1888 issue, 56 articles have been so far published. Copies containing these articles, sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

"Modern Locomotive Construction," by J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 70 articles have thus far appeared up to and including the August 4, 1888 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

MANUFACTURES

Dingly & Foss expect to build a shoe factory at Auburn, Maine.

Golden Brothers, Columbus, Ga., are enlarging their machine shop.

New & Miller are building a sash, door and blind factory at Bremer, Ga.

The White Paper Mills at Suffield, Conn., were recently destroyed by fire.

H. Gans & Sons are rebuilding their box factory, recently burned at St. Louis, Mo.

The Worcester (Mass.) Steel Works are to begin the manufacture of merchant steel.

The Knebel Engine Company, Birmingham, Ala., propose increasing their capital stock.

The Warrior Lumber Company, Warrior Station, Ala., will build a saw and planing mill.

The Kentucky Wagon M'f'g Co., Louisville, Ky., have increased their capital stock to $600,000.

The Lebanon (Pa.) M'f'g Company has advanced the wages of workmen from 5 to 15 per cent.

The Chattanooga (Tenn.) Union Railway Company are building machine shops at Chattanooga, Tenn.

The Canada Screw Company, of Hamilton, Ont., will increase their capital stock from $100,000 to $500,000.

The Seymour Cutlery Company's mill, at Holyoke, Mass., is being enlarged by an addition, 40 by 110 feet.

The Little Rock Furniture Company, whose factory at Little Rock, Ark., was recently burned, will be rebuilt.

The town of St. Johns, Quebec, Can., is prepared to guarantee special inducements for the location of manufacturers.

Holway, Sullivan & Co., Machias, Me., are building an annex to their lumber mill, to contain a clapboard machine.

The Campbell Machine Company, Pawtucket, R. I., are putting up a new building, to provide for increased facilities.

Archille D. Thomas, Pittsburgh, Pa., has doubled the capacity of his works. He makes a specialty of rolls for intricate forms.

The plow manufactory of John P. Hussey, at Gilmanton, N. H., recently burned, has been rebuilt and put in operation.

G. W. De Rochemont is building a machine shop and foundry for the manufacture of ornamental brass work, at Milford, Mass.

The Crucible Steel Works of the Cleveland Steel Company, in use by the Prospect Rolling Mill Company, were recently burned.

The Halifax Iron and Steel Manufacturing Company, of Halifax, N. S., has been incorporated, with $700,000 capital stock, for the purpose of manufacturing iron and steel.

The Ette & Henger Manufacturing Company, St. Louis, Mo., have increased the capacity of their foundry by about one-third. The company has also increased its machine shop facilities.

A. H. Bartell and others have organized a company to manufacture pressed brick at Junction, Kan. They have an unlimited quantity of excellent clay, and will make by the dry press process.

The Lawson Non-Explosive Boiler Company, New York, has issued a large illustrated circular, showing their manner of construction to avoid boiler explosions. Their office is 155-157 Broadway.

The Standard Leather Company, Newburyport, Mass., are to increase their capital to $60,000, they having found it necessary to do this in order to meet the largely increased demand for their goods.

The Ohio Valley Foundry Company built a large addition to their works at Bellaire last year, and now contemplate another which will double the capacity of the establishment and the number of workmen.

The Findlay (Ohio) Rolling Mill Company have purchased the works of the Sterling Chain Company, at Cuyahoga Falls, and will remove the machinery to Findlay. The works will have a capacity of ten tons of chain per day.

The firm of Hussey, Howe & Co., Pittsburgh, Pa., will hereafter be known as Howe, Brown & Co., Limited. The officers of the new firm are Jas. W. Brown, chairman; W. R. Howe, vice chairman; G. A. Howe, secretary; T. H. Childs, treasurer.

The Page Belting Company, Concord, N. H., report business as more than ordinarily active. Orders for large belts are afflicting this company, and the general orders of the company, of which we are informed, indicate that the bottom of business is yet sound.

The Helena (Mont.) Pressed Brick Company has been incorporated, with A. Kleinschmidt, president; F. L. Sizer, vice-president and general manager, and F. Maddox, secretary and treasurer. They will erect works at Claysoil Station, 13 miles east of Helena, on the N. P. R. R.

The Wheatland (Penn.) Plate Mill, after an idleness of fifteen years, is about to be put in operation as a bar mill. Two hundred and fifty men will be employed. The mill has been in litigation during the long shut-down, and now is to be operated by a Pittsburgh syndicate composed of the Woods heirs.

The Gregg Brick Company, of Topeka, Kan., has been organized, with a capital stock of $500,000. The directors are A. W. Ellet, Eldorado; D. P. Jones, Fort Scott; W. S. Gregg, Philadelphia; and H. C. Rizer, Topeka. The company have purchased the exclusive right to the manufacture, sale, and use of the Gregg brick machine in the States of Kansas, Missouri and Nebraska.

The Cartersville Iron and Steel Company has been organized at Cartersville, Ga., and it is stated will erect a large furnace at Cartersville, and that the plans and specifications of the furnace are drawn up and ready for bids. The company have contracted with the Pratt Steel Company, of Birmingham, Ala., for the use of their process for dephosphorizing iron in the blast furnace.

The new iron steamer to be built for the Canadian Pacific Railway Company by the Polson Iron Works Company, of Toronto, at their new shipbuilding yards at Owen Sound, Ont., will be 300 feet long, 38 feet beam and 23 feet 3 inches depth of hold. The engines and boilers to be put into her will be those of the Algoma, which are in perfectly sound condition and ready for service. These boilers weigh thirty-five tons each, and were made in Scotland.

Wm. Tod & Co., of Youngstown, Ohio, have now on the floor, nearly ready for shipment to the California Electric Light Company, San Francisco, a 700 horse-power compound engine of their Porter-Hamilton type, being the first compound of that type yet built by them. It is intended to run twelve dynamos, each supplying about 50 arc lights. The engine includes some details that are novel in their practice. This style of engine will be built in various sizes.

The Pacific mills, at Lawrence, Mass., are to build a new mill, which will be 325 feet long and 116 feet wide, three stories high, and devoted to spinning. The foundations are already laid. The storehouse, which is to be erected on the same lot, will be 213 feet long and 63 feet wide and six stories high. The new mill will give employment to about 600 operatives. Next year the company proposes to build another weaver shed as an extension of the one already erected in the upper Pacific yard.

The Washburn & Moen Manufacturing Company, Worcester, Mass., have issued their 1888 pocket handbook of copper and iron wire in electric transmission. The book, which it is fair to presume is issued for purposes of gain, appears to be in reality a compendium of facts that will interest everyone in any way connected with electrical matters. Without in any way entering into the merits of this little work, we should advise everyone interested in electrical matters to get a copy of this little hand-book.

A press dispatch from Richmond, Va., says: The Gray National Telautograph Company has been chartered by the circuit court, with a capital stock not to exceed $15,000,000. The principal office will be located in Richmond. The officers are: President, Thomas M. Logan; vice-president, Charles A. Corn, New York; secretary, David Yearson, New York. Among the incorporators are United States Senators Plumb and Hale, John H. Inman, George Scott, C. S. Brice, J. S. Pace and James H. Dooley. The company will engage in general telegraph and telephone business under the system invented by Professor Elisha Gray.

The Bellaire [Ohio] Nail Works, except factory, are running as full as the extreme hot weather will permit. The furnace is doing its usual work. Among the many improvements in the steel works is the establishment of a machine that appears to be destined to inaugurate many important changes in the manipulation of steel. It is called the ingot manipulator, and is for the purpose of turning the ingot on the table and moving it into the desired position. It is simple in construction, and, within certain limits, appears to be effective. Its economy consists in dispensing with the labor of two to three men on each turn.

The famous Wrought Rim Pulley Company—Messrs. Kilpatrick & Hunleth—started up the factory recently purchased from the St. Louis Pulley Company, situated on Trudeau and Kosciusko streets [St. Louis, Mo.] on the 6th inst. They are now turning out from fifty to seventy-five pulleys a day, large and small, and have already shipped several heavy orders to Chicago and Cincinnati, to say nothing of considerable local wants supplied by them. The wrought rim pulleys have been improved very noticeably since the manufacture of the same passed into their hands. The Standard foundry of the company, on Collins street, is also reported to be well supplied with orders for machine-molded pulleys.—*Age of Steel.*

The *Labor Tribune*, Pittsburgh, Pa., says: Nearly every branch in the iron and steel trade looks encouraging, and the prospects for a good run to the end of the year are very fair. The only firms to sign the scale now are the Keystone, the Elba Iron and Bolt Works, and the old Eagle at Sawmill run. Nothing has been done in the latter since September, and before then it was run about eight months in the last six years, which was on a lease by the Continental Tube Company. With the prospects in the pipe business now, it may be leased again. About a half dozen of those mills that are running now are on six heats, yet the most of them cannot get ahead of their orders by running day and night.

A late improvement, brought out by J. & J. B. Milholland, of Pittsburgh, Pa., manufacturers of wire rope haulage plants for use in mines, is machinery to haul a line of 60 to 80 cars around a right angle, by means of a large sheave, without the necessity, as heretofore, of employing a series of sheaves and cutting away the ground in a curve of long radius. Their latest haulage plants are direct acting, with drums mounted on the engine shafts, and arranged to put the power into the cylinders instead of the gearing. About 75 of their wire rope haulage plants are now in successful operation. While they build hoisting machinery, their specialty has rather been hauling loads on a level or along moderate grades. This firm have only recently begun building light locomotives for mining and similar purposes though one built by them 18 years ago is still in active use. They employ 50 men.

We have received the following from the Gage Tool Company, Vineland, N. J.: We presented a set of planes to Cornell University for trial in the Sibley College of Mechanic Arts more than a year ago. Prof. Morris wrote us in March, '87, highly commending them, and again in August, '87. We did not expect to receive an order for our planes, as we learned that they had nearly 100 planes of the best makes, both iron and wood, in their workshops—we were glad to get Prof. Morris' letters, which have been of great advantage to us. We are now agreeably surprised to receive an order for a large number of our planes. We think you will pardon us for feeling quite elated over this, as our planes have been in direct competition with what were previously considered the best planes, and have been preferred, notwithstanding cost, thus endorsing our claim to make the "best plane in the world," and giving the best value for the price. We think it would interest your readers to know that the plane illustrated last year in your journal was all that was claimed for it.

Machinists' Supplies and Iron.

NEW YORK, Aug. 23, 1888.

Iron—American Pig—The condition of the market remains about the same as at our last report, and prices are without changes of importance. We quote Standard Lehigh and North River brands $17.50 to $18 for No. 1 X Foundry, $16.50 to $17 for No. 2, and $15 to $16 for Grey Forge. Other brands are 50c. to $1 below these prices.

Scotch Pig—Coltness, $19.50 to $19.75; Glengarnock, $19.25 to $19.50; Gartsherrie, $19.75 to $20; Summerlee, $19.25 to $19.50; Eglinton, $17.50 to $17.75; Langloan, $19 to $19.50; Dalmellington, $18 to $18.25; and Clyde, $19 to $19.50.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Men to examine S. S. planes; see p. 11.

Wanted—Travelers for New England and Middle States, to handle mechanical goods; liberal commission. BOX 17, AMERICAN MACHINIST.

Mechanical engineer and draftsman, experience here and abroad, desires engagement. Address BOX 18, AMERICAN MACHINIST.

Wanted—To make arrangements with a good house to travel with steam goods, west or east; have had 13 years' experience; know the trade well. Address M., AMERICAN MACHINIST.

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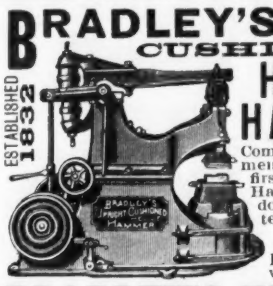

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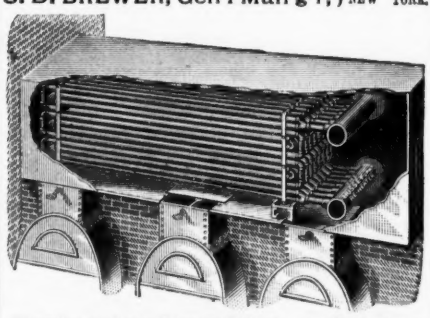

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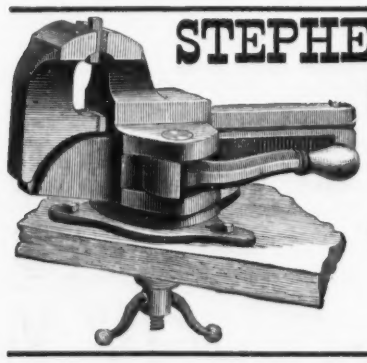

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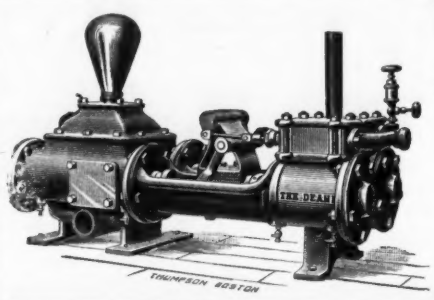

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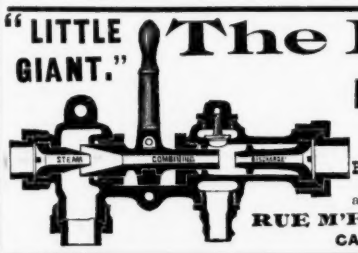

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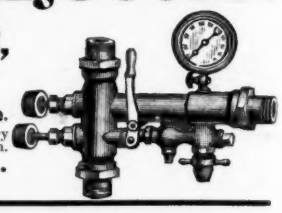

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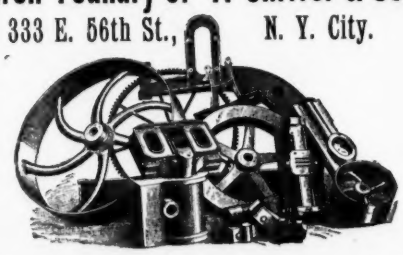

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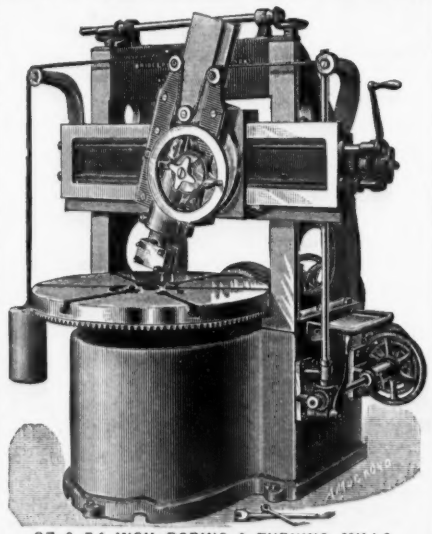

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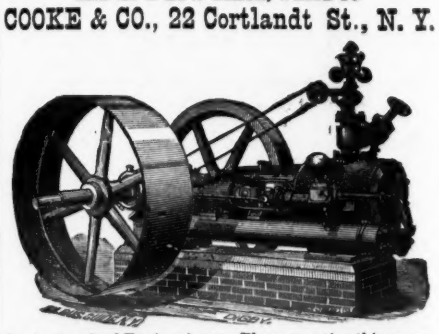

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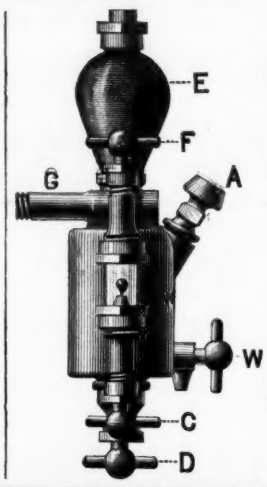

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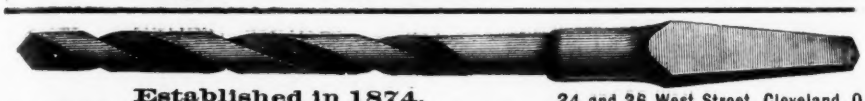

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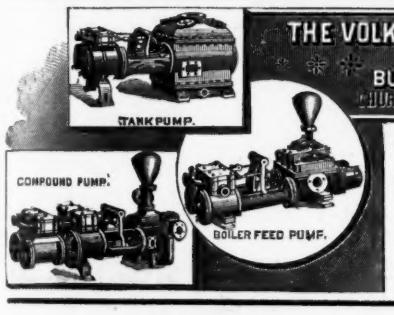

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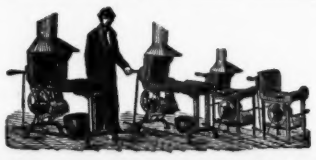

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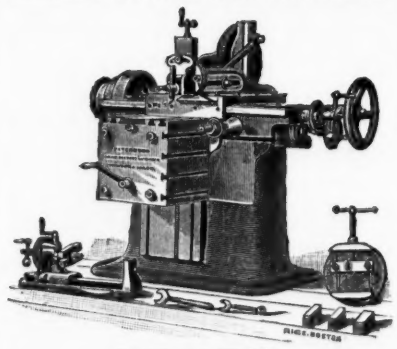

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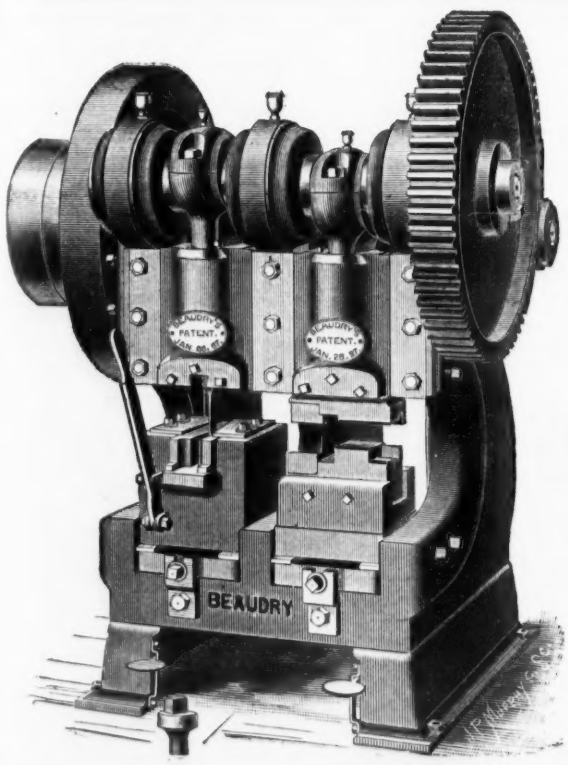

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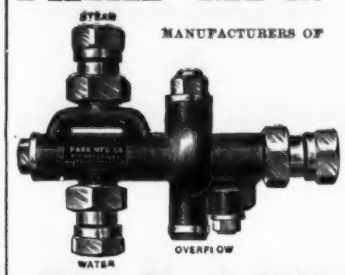

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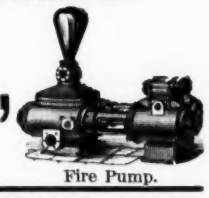

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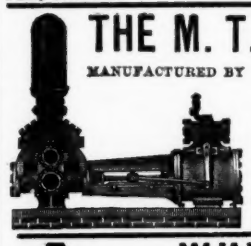

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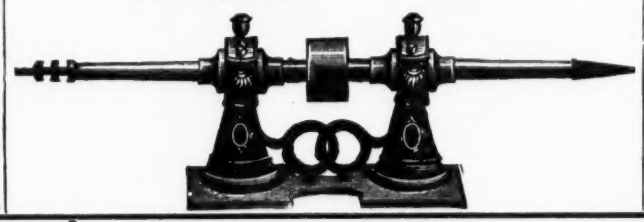

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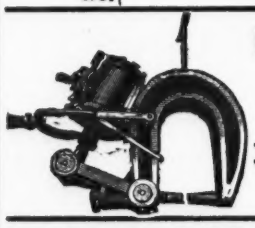

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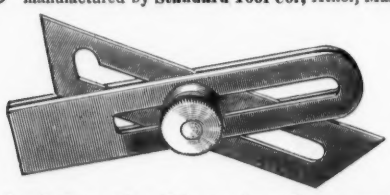

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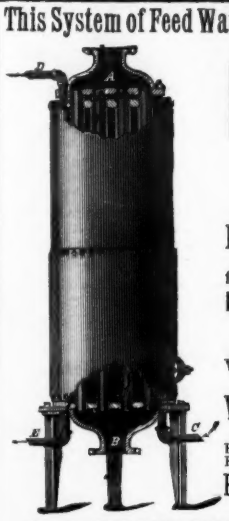

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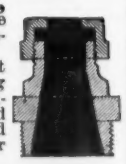

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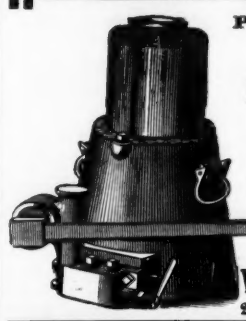

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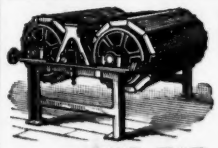

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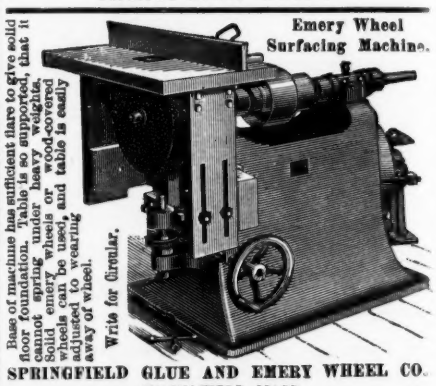
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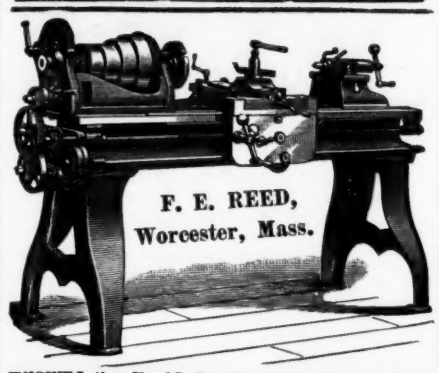

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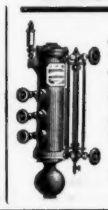

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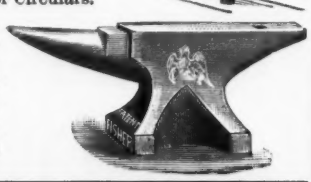

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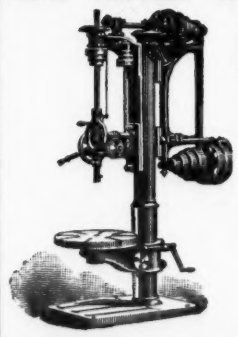

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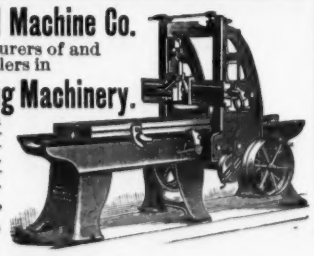

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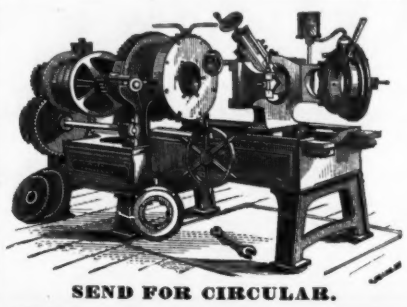

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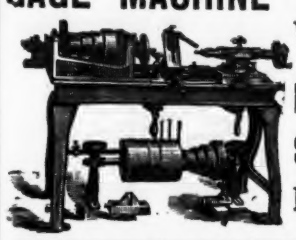

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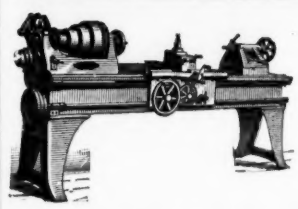

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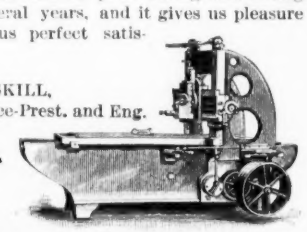

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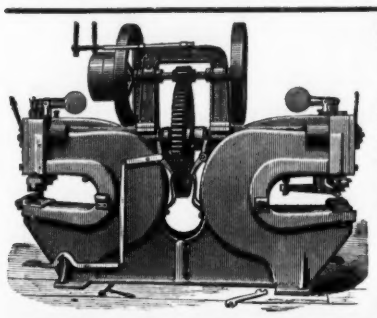

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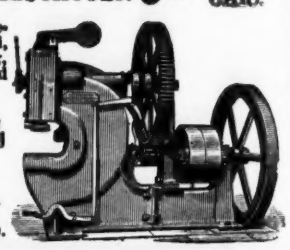

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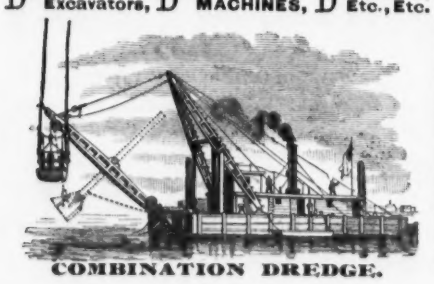

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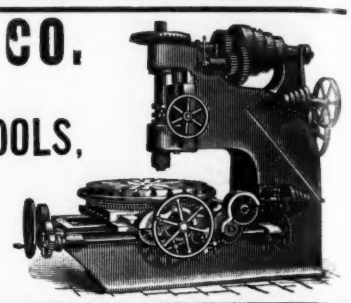

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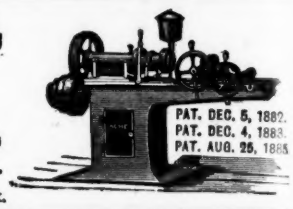

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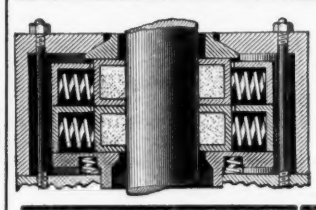

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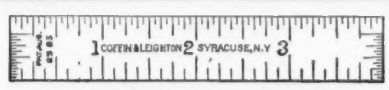

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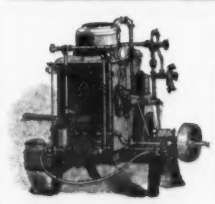

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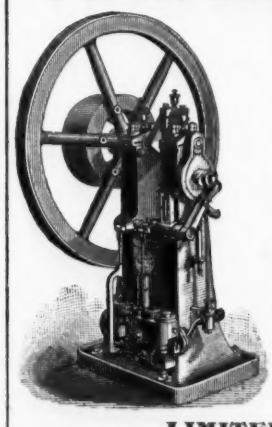

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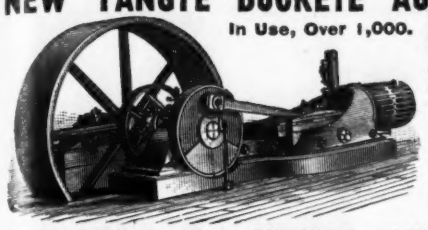

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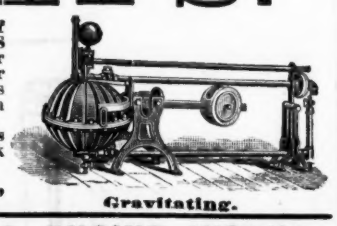

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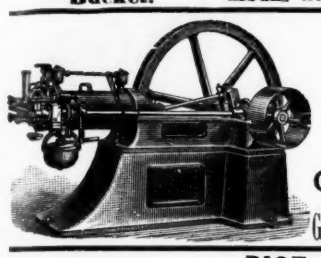

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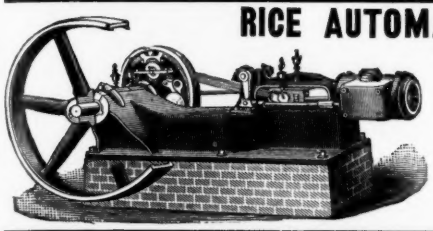

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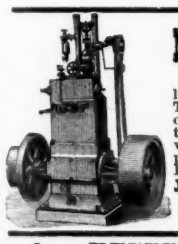

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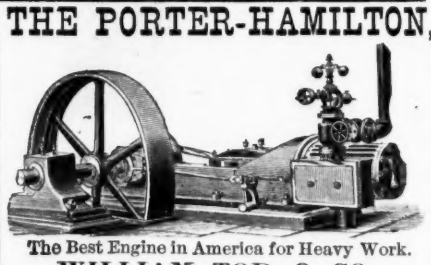

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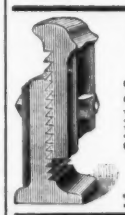

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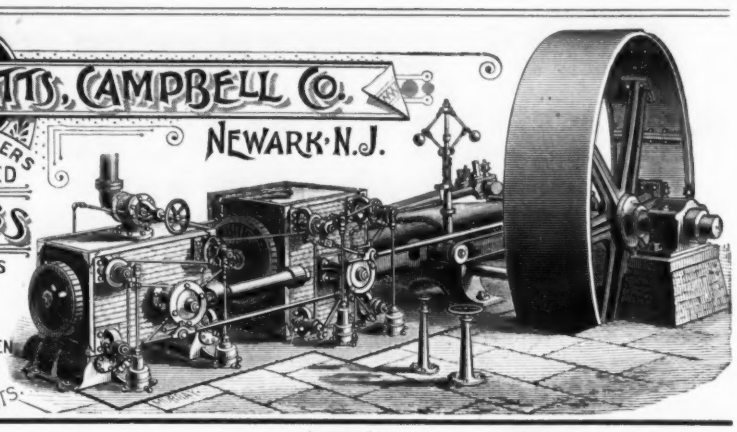

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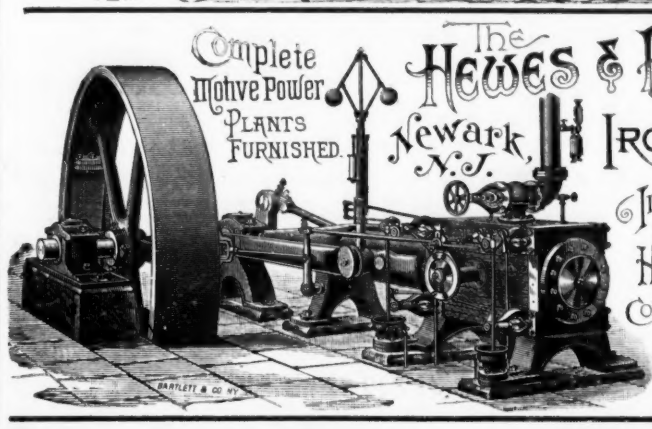

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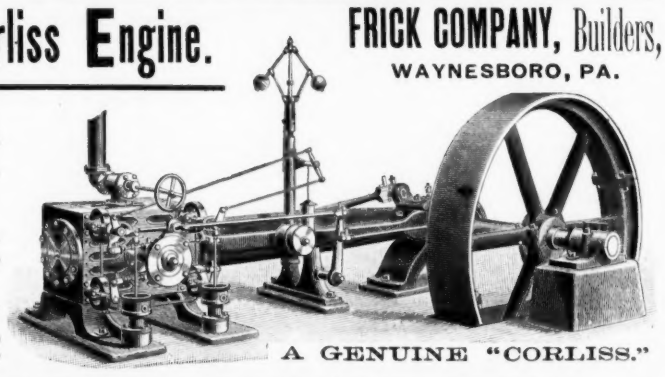

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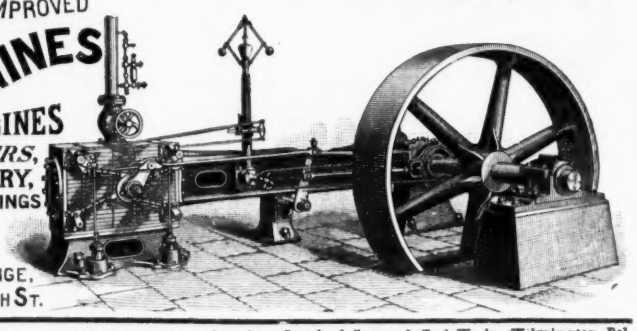

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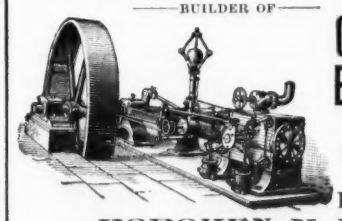

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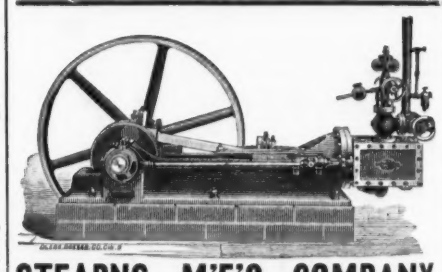

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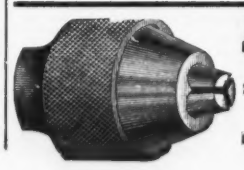

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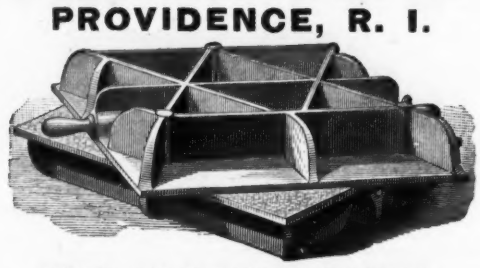

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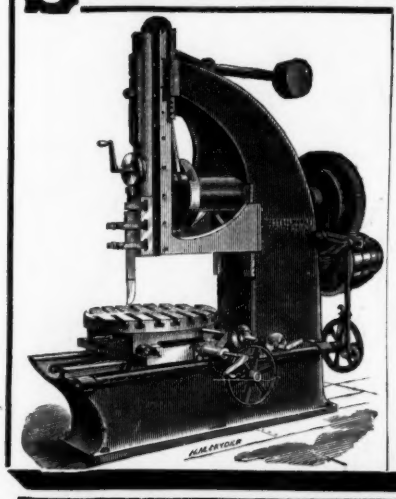

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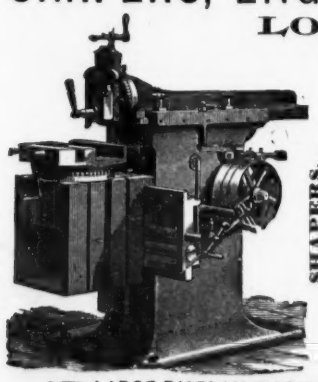
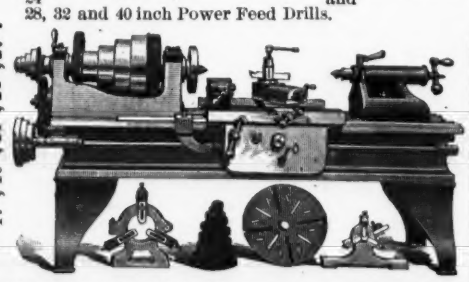


SHAPERS, 8", 10", 15", 20", 26", 32" Stroke.
ENGINE LATHES, 17", 19", 21", 24", 27".



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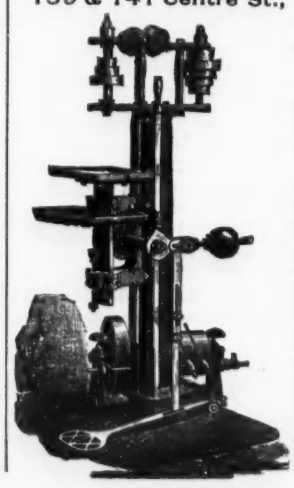

The machine shown in cut is especially designed for jobbing, and is fitted up with one or two spindles. Those with two spindles have pulley, with two sections, which gives two speeds to each spindle. Those fitted up with one spindle have a cone pulley with three sizes. The back shaft has a cone pulley with four sizes.

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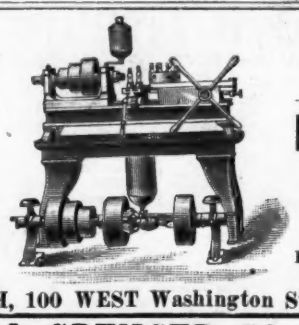

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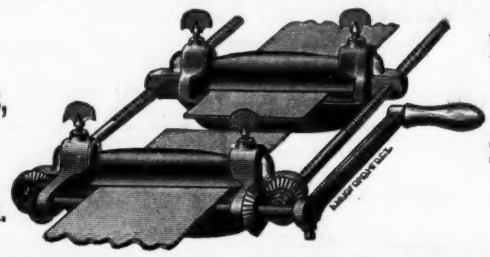

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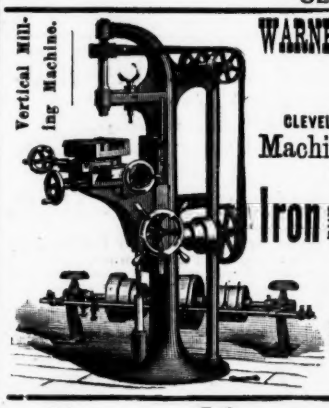

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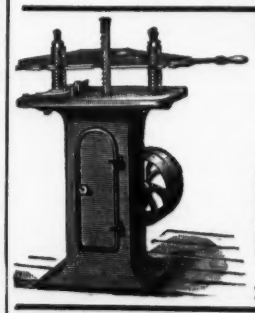

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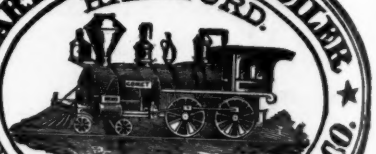

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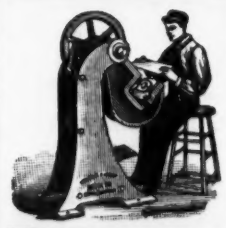

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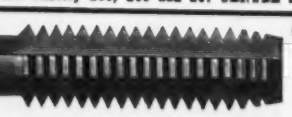

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